

# CHALLENGES AND OPPORTUNITIES IN THE 5 GHZ SPECTRUM BAND

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## HEARING BEFORE THE SUBCOMMITTEE ON COMMUNICATIONS AND TECHNOLOGY OF THE COMMITTEE ON ENERGY AND COMMERCE HOUSE OF REPRESENTATIVES ONE HUNDRED THIRTEENTH CONGRESS

FIRST SESSION

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## CHALLENGES AND OPPORTUNITIES IN THE 5 GHZ SPECTRUM BAND

WEDNESDAY, NOVEMBER 13, 2013

HOUSE OF REPRESENTATIVES,  
SUBCOMMITTEE ON COMMUNICATIONS AND TECHNOLOGY,  
COMMITTEE ON ENERGY AND COMMERCE,  
*Washington, DC.*

The subcommittee met, pursuant to call, at 2:27 p.m., in room 2123 of the Rayburn House Office Building, Hon. Greg Walden (chairman of the subcommittee) presiding.

Members present: Representatives Walden, Latta, Shimkus, Terry, Blackburn, Scalise, Lance, Guthrie, Long, Ellmers, Eshoo, Braley, Lujan, Dingell, Butterfield, and Waxman (ex officio).

Staff present: Gary Andres, Staff Director; Ray Baum, Senior Policy Advisor/Director of Coalitions; Matt Bravo, Professional Staff Member; Andy Duberstein, Deputy Press Secretary; Kelsey Guyselman, Counsel, Telecom; Grace Koh, Counsel, Telecom; Gib Mullan, Chief Counsel, CMT; David Redl, Counsel, Telecom; Charlotte Savercool, Legislative Coordinator; Tom Wilbur, Digital Media Advisor; Roger Sherman, Democratic Chief Counsel; Shawn Chang, Democratic Chief Counsel, Communications and Technology; Margaret McCarthy, Democratic Professional Staff Member; Kara van Stralen, Democratic Policy Analyst; and Patrick Donovan, Democratic FCC Detailee.

Mr. WALDEN. I am going to call to order the Subcommittee on Communications and Technology for our hearing on “Challenges and Opportunities of the 5 Gigahertz Spectrum Band.” With unanimous consent, Mr. Waxman has to be down at the White House. Without objection, I would like to start and allow him to give his opening statement as a courtesy to the former chairman, unless anybody wants to object or—I didn’t think so. So we will start. I know it is out of protocol and all, but we actually try and get along here from time to time. So I would yield to Mr. Waxman and allow him to give his statement since he has to depart.

### OPENING STATEMENT OF HON. HENRY A. WAXMAN, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF CALIFORNIA

Mr. WAXMAN. Thank you, Mr. Chairman. I thank you and Ms. Eshoo for your courtesy in allowing me to go forward. And I thank my other colleagues that are here for not objecting. I appreciate we are holding this hearing on the promises and challenges of freeing up additional spectrum in the 5 gigahertz band for next generation Wi-fi services.

Public Safety and Spectrum Act of 2012 contained a small but important revision requiring NTIA and the FCC to study and open up additional spectrum for unlicensed services in the 5 gigahertz band. Many members of this committee, including Ranking Member Eshoo and Congresswoman Matsui, worked hard to ensure this provision was included in the final legislation. And because of these efforts, superfast unlicensed services known as gigabit Wi-fi are closer than ever to becoming a reality. We know that unlicensed spectrum has been an incredible economic success story. The development of Wi-fi could not have happened without it. But as existing unlicensed bands become increasingly congested, we must open up additional frequencies for Wi-fi services to meet skyrocketing consumer demand. And the potential for delivering unprecedented data speed over gigabit Wi-fi networks promises to transform the 5 gigahertz band into a test bed for breakthroughs in innovation.

Unlicensed spectrum is essential to our Nation's wireless broadband ecosystem in unlocking the potential of the 5 gigahertz band is critical to maintaining our global leadership in mobile broadband. Making more Wi-fi spectrum available does not come without challenges.

As a threshold matter, we must ensure incumbent systems in the band, whether they are operated by federal or commercial users, are fully protected from harmful interference. In particular, the lifesaving potential of state of the art driver warning systems must not be undermined. We are in the early stage in opening up the 5 gigahertz band, and I believe any process going forward must be fair, transparent and driven by engineering. As I stated last year, the Administration should continue to pursue an all of the above approach to make more spectrum available for commercial mobile broadband services. This approach includes opening up underutilized spectrum for sharing. In an increasingly crowded spectrum world, spectrum sharing shall be the new normal, not the exception. All stakeholders should work together to develop sound technical solutions to make this possible.

I would like to welcome our impressive panel of experts. Mr. Knapp, welcome back to our committee. We have always appreciated your efforts to explain highly technical issues in language policymakers can understand most of the time. And I know you will help us again today. I look forward to hearing from all of our panel of experts.

Finally, I would like to take a moment, a personal privilege to acknowledge Roger Sherman, as today's hearing will be the last he will participate in as a member of our committee staff. Members of the committee know Roger not only for his deep expertise on telecommunications matters before this subcommittee, but also his wise guidance as Democratic Chief Counsel. Roger's dedication and knowledge and pragmatism truly exemplify the best of public service. Fortunately, Roger will still work closely with us in his new role as a Wireless Bureau Chief of the Federal Communications Commission. In that capacity, he will play an instrumental role in ensuring the success of the upcoming spectrum auctions, including the broadcast incentive auction. This is perhaps the FCC's most critical responsibility in the coming years at FCC. Chairman Wheeler couldn't have picked a better person for the job. I know



others may want to comment on his leaving us as well. I hope everyone will join me in congratulating Roger on this new opportunity, and we wish him all the success. I have 39 seconds. I am going to yield to Ms. Eshoo.

Ms. ESHOO. Or I will use my time when you acknowledge me.

Mr. WAXMAN. OK. Good.

Ms. ESHOO. Thank you.

Mr. WAXMAN. Thank you, both.

Ms. ESHOO. Thank you.

Mr. WALDEN. The gentleman yields back his time. I want to join the gentleman in honoring Roger and thanking him for his many years of service here on the committee and for the people of America, and your continued service. Let the record show, I already have a draft letter to you in your new role. And, you know, it has a couple of minor things I am sure you can fix. But we are delighted that you are going to stay part of the public process. And we welcome you in your new role. We regret you leaving here, but we wish you God speed and great fortune and safety.

Mr. WAXMAN. And we want your responses by 9:00 a.m. tomorrow morning.

Mr. WALDEN. Mr. Waxman, that would be 8:00. Yes, that is probably on time.

Mr. WAXMAN. OK.

**OPENING STATEMENT OF HON. GREG WALDEN, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF OREGON**

Mr. WALDEN. All right. We will get back into regular order here, and I will give my opening remarks.

The subcommittee meets today to continue our oversight of the FCC's progress in implementing the spectrum provisions Congress passed last year as part of that Middle Class Tax Relief and Job Creation Act of 2012. While much has been made of the incentive auctions, and those first of their kind auctions are incredibly important, we also took concrete steps to improve access to spectrum for unlicensed technologies like Wi-fi in the 5 gigahertz band. Today, we will hear from witnesses that could give us an update on their progress in implementing those sections and what challenges exist to increased unlicensed use.

Unlicensed wireless technologies have become an indispensable part of our information infrastructure in the United States. As a complement to both our residential and business wired internet connections, as well as a component of our mobile wireless devices, Wi-fi, perhaps the most prolific use of unlicensed spectrum, has spread from its humble origins in a technical community to near ubiquity. It now helps farmers in rural America allocate water and fertilizer to meet the exact specific needs of crops, thus increasing productivity and reducing costs. It has allowed business of all kinds to more efficiently manage inventories, distribution and manufacturing processing, thus increasing productivity. It allows consumers to communicate on the go and to watch the video services they want, where and when they want to.

Unlicensed spectrum technologies have allowed all of us to use devices that have made our lives safer and more convenient, connected, informative and entertaining. It has and will continue to

help created billions of dollars of economic growth and hundreds of thousands of jobs across all of America.

Spectrum provisions that were signed into law last year had their beginnings in this subcommittee. We instructed the NTIA and the FCC to begin the process of bringing additional spectrum into the unlicensed marketplace by first asking them to assess the feasibility of doing so without causing harmful interference to licensed operators already occupying the band. Just as we had a central focus on ensuring that broadcaster remained a viable service after the incentive auction, so too did we have a focus on ensuring that new unlicensed uses were in addition to and not interfering with existing licensed services. The 5 gigahertz ecosystem is teeming with existing uses from critical government radar systems to commercial satellites. There are a host of licensed services that are already deployed in this band.

Today, we will also hear from one of the promising but unrealized license uses of this band, intelligent transportation systems for smarter, safer vehicles. However, it is important to also note that 5 gigahertz is also currently being used for Wi-fi and other unlicensed uses. Thanks to technical rules that limit power and require certain mitigation technologies, these systems are currently meeting our licensed and unlicensed needs without interfering with one another.

So we are looking forward to hearing from our very qualified panel of witnesses this afternoon on both the potential that this spectrum holds to fuel the next generation of unlicensed wireless technologies and benefits they would bring, but also the technical and economic challenges to making the most of this band. I think I speak for many of my colleagues when I say that we are excited to see the fruits of this subcommittee's labor come to fruition in the form of faster and more abundant Wi-fi, but not at the expense of existing licensed services. These services can coexist. And thanks to the hard work of the industries and agencies represented by our witnesses today, we don't have to choose between better internet access and safer cars. So I thank you for being here. And I look forward to your testimony.

[The prepared statement of Mr. Walden follows:]

#### PREPARED STATEMENT OF HON. GREG WALDEN

The subcommittee meets today to continue our oversight of the FCC's progress in implementing the spectrum provisions Congress passed last year as part of the Middle Class Tax Relief and Job Creation Act of 2012. While much has been made of the incentive auctions—and those first-of-their-kind auctions are incredibly important—we also took concrete steps to improve access to spectrum for unlicensed technologies, like Wi-fi, in the 5 GHz band. Today, we will hear from witnesses that can give us an update on their progress in implementing those sections and what challenges exist to increased unlicensed use.

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It now helps farmers in rural America allocate water and fertilizer to meet the exact needs of a specific crop thus increasing productivity and reducing cost. It has allowed businesses of all kinds to more efficiently manage inventories, distribution and manufacturing processes thus increasing productivity. It allows consumers to communicate on the go and to watch the video services they want where and when

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The spectrum provisions that were signed into law last year had their beginnings in this subcommittee. We instructed the NTIA and the FCC to begin the process of bringing additional spectrum into the unlicensed marketplace by first asking them to assess the feasibility of doing so without causing harmful interference to licensed operators already occupying the band. Just as we had a central focus on ensuring that broadcasting remained a viable service after the incentive auction, so too did we have a focus on ensuring that new unlicensed uses were in addition to and not interfering with existing licensed services.

The 5 GHz ecosystem is teeming with existing uses. From critical government radar systems to commercial satellites, there are a host of licensed services that are already deployed in this band. Today we will also hear from one of the promising, but unrealized, licensed uses of this band: intelligent transportation systems for smarter, safer vehicles. However, it is important to also note that 5 GHz is also currently being used for Wi-fi and other unlicensed uses. Thanks to technical rules that limit power and require certain mitigation technologies, these systems are currently meeting our licensed and unlicensed needs without interfering with one another.

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# # #

Mr. WALDEN. With that, I would recognize the gentleman, the vice chair of the subcommittee from Ohio, Mr. Latta.

**OPENING STATEMENT OF HON. ROBERT E. LATTA, A  
REPRESENTATIVE IN CONGRESS FROM THE STATE OF OHIO**

Mr. LATTA. I thank the Chairman for yielding, and I appreciate our panel of witnesses for being with us today. And I look forward to hearing from your testimony today. I am going to begin by thanking my colleague, the gentlelady from California, Ms. Matsui, for working with me during our consideration of the Jump-starting Opportunity with Broadband Spectrum Act, which is ultimately included in the larger Middle Class Tax Relief and Job Creation Act, to include the language directing the FCC, NTIA and other agencies to study spectrum sharing possibilities in the 5 gigahertz band.

In the past, we have discussed the Federal Government's use of spectrum and the opportunities that exist for improving its use of this valuable asset, as well as our continued oversight of the upcoming incentive auction. Today's hearing offers us yet another opportunity to examine a portion of our Nation's overall spectrum policy. The 5 gigahertz band presents a unique opportunity to spur innovation and improve the performance of our licensed spectrum network by offloading much of the mobile data traffic to Wi-fi hotspots.

While I understand and respect the concerns that will be raised here today, I am confident the industry experts can find a way to optimize this valuable real estate and avoid harmful interference. The fact remains that we are in the midst of a spectrum crunch. And to remain the world's leading innovator and ensure consumer

demand is met, we must find ways to utilize spectrum more efficiently, making decisions on technical merits rather than the politics of the past.

Again, I would like to thank our witnesses for being here today. I look forward to your testimony. And Mr. Chairman, I yield back.

Mr. WALDEN. The gentleman yields back. The Chair recognizes the gentlelady from California, Ms. Eshoo, Ranking Member, for opening statement.

**OPENING STATEMENT OF HON. ANNA G. ESHOO, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF CALIFORNIA**

Ms. ESHOO. Thank you, Mr. Chairman, and welcome to our wonderful panel, amongst them my constituents. So welcome. And I am sorry someone turned down the thermostat. But just think, you are going to get back to California before I do. So thank you for being here.

Given the tremendous growth in Wi-fi usage and the need to maintain our Nation's lead in developing gigabit Wi-fi technology, thank you, Mr. Chairman, for holding today's hearing on the 5 gigahertz spectrum band.

The United States has been a world leader in unlicensed spectrum, and I think that this is something that we can't ever underappreciate its importance and the importance that we not just rest on our laurels, but that we continue to build on that. I have what I would term as a love affair with unlicensed. And I am very proud that in the spectrum bill to have really used those two terms—those two words, unlicensed spectrum, just over and over and over and over again to make sure that we honored what that represents for our country and the innovation platform that it is. Now, dating back to the FCC's decision nearly 30 years ago to open up spectrum for unlicensed use, we have been on a very important glide path since then. And since that time, billions of devices have been sold, and technologies such as Wi-fi and Bluetooth. I can't live without Bluetooth. I don't know about the rest of you. I mean, you get in the car and, you know, you would be hauled off to jail in California if you are seen holding any kind of device in your hand. So it is a reminder to me of how practical the uses are, how many they are and that they are really integrated into our lives. They are household names. They are enjoyed by millions of consumers around the country.

Now, by one estimate, in-home Wi-fi alone may be generating between \$4.3 and \$12.6 billion a year in U.S. economic value. That is pretty serious money, even around here. That is a lot. And I want to see it grow. When adding the larger unlicensed ecosystem, the figure rises to anywhere between \$50 and \$100 billion annually. But as Wi-fi demand has increased, so has congestion. And more than one Member has already spoken of this, particularly in the high trafficked areas such as airports, convention centers and university campuses.

With congestion increasing and consumers demanding faster data speeds, the FCC announced a proposal earlier this year to unleash up to 195 megahertz of spectrum in the 5 gigahertz band for unlicensed use. In July, to ensure the agency's timely implementa-

tion of the proposal, I wrote to Acting Chairwoman Clyburn, along with Representatives Latta, Matsui and Issa. In our letter, we emphasized the importance of spectrum sharing and urged the FCC to proceed expeditiously with collaboratively testing that includes both incumbents and the Wi-fi industry. I look forward to hearing an update on these issues during today's hearing. And I know that you are fully prepared for that, right? And good answers for us. Happy answers.

While the 5 gigahertz band is an important component of the 21st century unlicensed spectrum policy, it is complementary and not a substitute for low-band spectrum below 1 gigahertz. In fact, one such company who is innovating in this space is Adaptrum, a Silicon Valley startup. And last week, they shared this story with a bipartisan group of congressional staffers and explained how the superior propagation factors found in the television band will unlock new unlicensed innovations such as rural broadband access which so many members of this committee on both sides of the aisle have such a keen interest and responsibility for, and expanded urban applications that wouldn't be possible in higher bands of spectrum.

So I think the time to act is now. The FCC should move expeditiously to harmonize existing rules and make more spectrum available for gigabit Wi-fi. And again, I want to thank each one of our witnesses for being here today and testifying. And at some point, maybe at the end of the hearing, I'd like to get some great words of praise and commendation to Roger Sherman. But I have certainly gone past my time. And I yield back, Mr. Chairman. Thank you.

Mr. WALDEN. Gentlelady yields back.

Ms. ESHOO. And thank you for allowing Mr. Waxman and all members for that unanimous consent request. It was a gentlemanly thing to do.

Mr. WALDEN. Happy to do it.

Ms. ESHOO. Yes.

Mr. WALDEN. So anyone on the Republican side seek the last 5 minutes, or should we move on to the witnesses?

All right. So we will expedite our hearing and go to the experts. And we are delighted to have each of you here. Thank you for your submitted testimony, your willingness to give the abbreviated versions this morning, or this afternoon, and take our questions. We will lead off with the Chief of the Office of Engineering and Technology of the Federal Communications Commission, Mr. Julius Knapp. Julius, it is good to have you back before the committee. I concur with Mr. Waxman. It is always helpful as you translate technical engineering issues into understandable policies. So the microphone is yours sir, and go ahead.

**STATEMENTS OF JULIUS KNAPP, CHIEF, OFFICE OF ENGINEERING AND TECHNOLOGY, FEDERAL COMMUNICATIONS COMMISSION; JOHN KENNEY, PRINCIPAL RESEARCH MANAGER, TOYOTA INFO TECHNOLOGY CENTER; TOM NAGEL, SENIOR VICE PRESIDENT, BUSINESS DEVELOPMENT, COMCAST; AND BOB FRIDAY, VICE PRESIDENT AND CHIEF TECHNOLOGY OFFICER, CISCO**

**STATEMENT OF JULIUS KNAPP**

Mr. KNAPP. Thank you. Good afternoon, Chairman Walden, Ranking Member Eshoo and members of the subcommittee. Thank you for this opportunity to provide you with the status report of the FCC's efforts to provide more access to unlicensed spectrum in the 5 gigahertz frequency band. As the very title of this hearing reads, this process presents numerous engineering challenges. But increased access to unlicensed spectrum in this band could greatly accelerate growth in expansion of new Wi-fi technology, offering faster speeds, increasing overall capacity and reducing congestion at hotspots. Unlicensed spectrum has been a phenomenal success story. Innovations that utilize these airwaves affect virtually every aspect of our daily lives, including Wi-fi networks that we use in our homes and at public hotspots, Bluetooth technology for connecting mobile devices with wireless headsets and speakers, and for connecting computer tablets and keyboards, electronic keys for opening car doors, identification badges for secure access to buildings, and many other products that are too numerous to mention. Unlicensed technologies have spurred creation of entire new industries in jobs to the benefit of businesses, consumers and our overall economy.

Congress recognized the importance of providing additional spectrum for both licensed and unlicensed use in the Middle Class Tax Relief and Jobs Creation Act. This law specifically directs the NTIA and the FCC to examine the potential for expanded unlicensed use in the 5 gigahertz spectrum. In February of this year, the Commission adopted a notice of proposed rulemaking, or NPRM, that satisfies the requirements of Section 6406(a) of the Act. The Commission's NPRM was focused on 3 separate portions of the 5 gigahertz band. The first portion involves 100 megahertz of existing unlicensed spectrum at the low end of the band. The Commission proposed to remove the restriction on indoor use and to allow higher power consistent with the other parts of the 5 gigahertz unlicensed spectrum. These actions would make the spectrum much more usable for Wi-fi and other technologies.

The second portion of the NPRM would make 120 megahertz of spectrum available in the middle of the 5 gigahertz band, essentially filling in the gap that exists in the existing 5 gigahertz spectrum. It would create a large contiguous block. This would allow more flexibility to accommodate the greater bandwidths of the latest technologies. This band is used by the Department of Defense and a number of other federal agencies.

The third portion would make 75 megahertz of spectrum available to extend the upper end of the 5 gigahertz unlicensed band. This spectrum is allocated for intelligent transportation services such as the dedicated short range communication systems, or

DSRC, for vehicle to vehicle and vehicle to infrastructure technology. These actions would make up to 195 megahertz of additional spectrum available for unlicensed use in the 5 gigahertz band, a 35 percent increase of the 555 that is available there now. They would also enable greater use of the latest industry Wi-fi standard 802.11ac that uses wider channel bandwidths of up to 160 megahertz to provide data rates of 1 gigabit per second or more.

Because of the existing incumbent users in the three 5 gigahertz band, making more spectrum usable, or usable at all for unlicensed use will be challenging. But the importance of the 5 gigahertz band and the benefits of unlicensed spectrum generally are clear, and the Commission has indicated its strong desire to move forward in seeking to resolve these challenges.

Finally, I want to emphasize that the Commission has not proposed to take away any incumbent user's right to operate as a licensed service in the 5 gigahertz band. As with all unlicensed services, these devices may not cause harmful interference to licensed services and must accept whatever interference that they receive. It is my hope that all parties will work together in good faith to overcome these technical and policy challenges, and that we will be able to find a way to effectively share the spectrum that I describe today. Thank you, and I look forward to your questions.

[The prepared statement of Mr. Knapp follows:]

**Testimony of  
Julius P. Knapp  
Chief, Office of Engineering and Technology  
Federal Communications Commission**

**Before  
The U.S. House of Representatives Committee on Energy and Commerce  
Subcommittee on Communications and Technology**

**“Challenges and Opportunities in the 5 GHz Spectrum Band”**

**Wednesday, November 13, 2013  
2:00 p.m.  
2123 Rayburn House Office Building  
Washington, D.C.**

Good morning Chairman Walden, Ranking Member Eshoo, and Members of the Subcommittee. Thank you for this opportunity to provide you with a status report of the Federal Communication Commission’s efforts to provide more access to unlicensed spectrum in the 5 GHz frequency band. As the very title of this hearing notes, this process presents numerous engineering challenges. But increased access to unlicensed spectrum in this band could greatly accelerate the growth and expansion of new Wi-Fi technology – offering faster speeds, increasing overall capacity, and reducing congestion at hot spots.

In my role as the Chief of the FCC’s Office of Engineering and Technology (OET), I advise the Commission concerning a broad range of engineering issues. Among other responsibilities, OET’s mission is to create new opportunities for competitive technologies and services for the American public. As part of this work, OET has the responsibility for overseeing unlicensed spectrum, as governed by Part 15 of the Commission’s rules.

Unlicensed spectrum has been a phenomenal success story. Innovations that utilize these airwaves affect virtually every aspect of our daily lives, including the Wi-Fi networks that we use in our homes and at public hot-spots, Bluetooth technology for connecting mobile devices with wireless headsets and speakers – and for connecting computer tablets with keyboards, electronic keys for opening car doors, identification badges for secure access to buildings, and



many other products too numerous to mention. Unlicensed technologies have spurred creation of entire new industries and jobs, to the benefit of businesses, consumers, and our overall economy.

And if the past is any indicator of the future, the opportunities for innovative unlicensed products and services are almost limitless. Unlicensed spectrum is already playing a vital role in meeting our nation's broadband needs. Earlier this year, Cisco estimated that 47% of all mobile traffic in the United States is offloaded onto Wi-Fi, and projects that offloading will grow to 66% by 2017. Cisco also predicts that by 2017, 62% of all Internet traffic will be carried over Wi-Fi networks.

Congress recognized the importance of providing additional spectrum for both licensed and unlicensed use in the Middle Class Tax Relief and Jobs Creation Act. This law specifically directs the National Telecommunications and Information Administration (NTIA) and FCC to examine the potential for expanded unlicensed use in the 5 GHz frequency band. In February of this year, the Commission adopted a Notice of Proposed Rulemaking (NPRM) that satisfies the requirements of Section 6406 (a) of the Act. The proposal would modify existing FCC rules to make some unlicensed 5 GHz spectrum more usable, and provide access to additional, new unlicensed spectrum in that band.

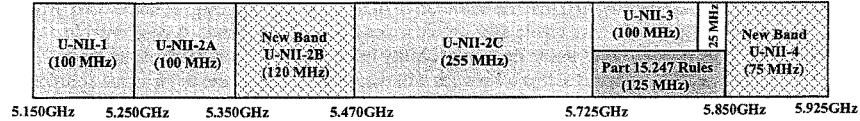
Unlicensed National Information Infrastructure (U-NII) devices today operate in 555 megahertz of spectrum in the 5 GHz band, and are used for Wi-Fi enabled local area networks to connect smart phones, tablets, and laptops to the broadband network. This spectrum also supports broadband services offered by Wireless Internet Service Providers (WISPs), particularly in rural areas.

The Commission proposed making up to 195 megahertz of additional spectrum in the 5 GHz band (a 35% increase) available to unlicensed wireless devices. It also proposed a more robust use of 100 megahertz of the existing unlicensed spectrum, and streamlining existing rules and equipment authorization procedures for devices throughout the 5 GHz band. The proposed modifications would provide access to additional contiguous spectrum with consistent technical requirements, allowing unlicensed devices to use wider bandwidth channels, leading to faster speeds.

The Commission's proposed rules also would enable greater use of the latest industry Wi-Fi standard, IEEE 802.11ac, that uses wider channel bandwidths of up to 160 megahertz to provide data rates of 1 Gbit/s or more. This new standard presents exciting opportunities for growth of unlicensed devices and services in the 5 GHz band.

Importantly, the Commission recognized the numerous challenges to making additional spectrum available in the 5 GHz band. Because the band is already used for other purposes by both federal and non-federal users, permitting additional shared use requires significant collaboration with stakeholders to enable non-interfering shared use of the spectrum.

The Commission focused its NPRM on three separate portions of the 5 GHz band, each of which I describe briefly below. This chart illustrates the location and size of the bands.



### U-NII-1

Currently, the 100 megahertz U-NII-1 band from 5150-5250 MHz is available for unlicensed use only indoors, and at relatively low power levels. Because of those restrictions, it is not heavily used for Wi-Fi.

The Commission asked whether it should harmonize the power and use conditions across the lower 200 megahertz of U-NII spectrum to permit the introduction of a wide-range of new broadband products capable of operating at higher data rates than is now possible.

In its ongoing work to examine the potential use of other frequency bands for broadband purposes, NTIA and the Department of Defense (DoD) had also considered new uses for some of the 5 GHz spectrum, including relocating certain DoD systems that currently operate in the 1755-1850 MHz band into the 5150-5250 MHz band. Recently, however, DoD has proposed an alternative approach that would not require additional DoD access to the 5150-5250 MHz band.

### U-NII-2B

Today, the proposed 120 megahertz U-NII-2B band from 5350-5470 megahertz is primarily used by DoD radars for various purposes in both terrestrial and airborne configurations. Many of these radar applications are similar to those in the adjacent frequency bands where sharing is accomplished through use of Dynamic Frequency Selection (DFS) technologies. Unlicensed devices use DFS monitor channels to detect the presence of a radar within that channel. When a radar is detected, the unlicensed device will cease using that channel, and move to another frequency in order to avoid interfering with the radar.

Initial studies have indicated that interference mitigation in addition to DFS may be necessary to protect all of the radar types used in the 5350-5470 MHz band. NTIA is currently studying compatibility between proposed U-NII equipment and the incumbent radar users. Both federal agencies and industry representatives have been continuing their efforts to complete these analyses.

### U-NII-4

The proposed 75 megahertz U-NII-4 band from 5850-5925 MHz is currently used by DoD radars, Amateur Radio Service, and Intelligent Transportation Systems such as the Dedicated Short Range Communications Systems (DSRC) for vehicle to vehicle technology. We understand that an extensive amount of research and investment has gone into developing the

DSRC over the past decade, and that the automotive industry and proponents of unlicensed use have recently begun evaluating viable sharing scenarios in the 5 GHz band. A considerable amount of work remains to examine the compatibility between unlicensed devices and these incumbent uses. We are hopeful that all parties will work together to come to technical solutions that will permit unlicensed operations in this band to coexist with DSRC and other systems.

### **Conclusion**

Because of the existing incumbent users in the three 5 GHz bands, making the spectrum more usable – or usable at all – for unlicensed use, will be challenging. But the importance of the 5 GHz band, and the benefits of unlicensed spectrum generally are clear, and the Commission has indicated its strong desire to move forward in seeking to resolve those challenges.

Many others share the Commission's interest in this band. The Commission received 65 comments and 32 replies during the comment period that closed on July 24, 2013. Ex parte comments also continue to be filed, as the FCC meets with the interested parties from the Wi-Fi industry, wireless internet service providers, the cable industry, the transportation industry, and others.

Finally, I want to emphasize that the Commission has not proposed to take away any incumbent user's right to operate as a licensed service in the 5 GHz band. As with all unlicensed services, U-NII devices may not cause harmful interference to licensed services, and must accept any harmful interference that they receive. It is my hope that all parties will work together in good faith to overcome these technical and policy challenges, and that we will be able to find a way to effectively share all 295 megahertz of the spectrum I described today.

Thank you and I look forward to your questions.

Mr. WALDEN. Mr. Knapp, thank you for your presentation and your testimony, and we look forward to speaking with you more about that. We are going to go now—make sure I get the right title—to Mr. Kenney, who is the Principle Research Manager for Toyota Info Technology Center. Mr. Kenney, we are delighted to have you here today. We look forward to your testimony as well, sir. Go ahead.

#### STATEMENT OF JOHN KENNEY

Mr. KENNEY. Chairman Walden, Ranking Member Eshoo, members of the subcommittee, thank you for the opportunity to testify before you today. My name is John Kenney. I am a principal researcher at the Toyota Info Technology Center in Mountain View, California, where I lead our vehicular networking research team.

Despite remarkable advances in the crashworthiness of vehicles, tens of thousands of Americans are still dying in traffic accidents each year. We firmly believe that the next great opportunity to reduce fatalities rests with technologies that will prevent crashes in the first place. Dedicated short range communication, or DSRC, is such a technology. DSRC enables vehicles to communicate with each other. DSRC vehicles broadcast precise information such as location, speed and acceleration several times per second over a range of a few hundred meters. Other DSRC vehicles receive these messages, use them to determine if any neighboring vehicles pose a collision threat, and then warn drivers of those threats. DSRC vehicles can also receive safety-related information from roadside infrastructure such as the state of an upcoming traffic light or the presence of ice, a disabled vehicle or a pedestrian in the road.

NHTSA concluded that connected vehicle technology has the potential to address approximately 80 percent of crashes involved non-impaired drivers. They further determined that DSRC at 5.9 gigahertz is “the only communication option at this time capable of effectively and reliably providing the safety of life capability.” DSRC can and almost certainly will be used for other non-safety applications.

Just as the Internet has moved far beyond its original email and file transfer applications, DSRC is also likely to unleash innovative connected car applications that go far beyond collision avoidance. I recognize that there is some skepticism about DSRC and concerns that the benefits are being overstated, or that the automakers will never bring the technology to market. I can assure you that Toyota is committed to DSRC as a critical safety technology. We have already commercialized DSRC in other markets and would like to bring it to drivers in the United States in the near future.

And we are not alone in this. The auto industry has been working hard here in the United States to pave the way for DSRC deployment, leading to the publication of core technical standards in 2009 and 2010. U.S. DOT is also conducting research and field testing with Toyota and other automobile companies to prepare for widespread deployment of crash avoidance systems that use DSRC. At this point, pre-production prototypes have been developed and are currently supporting large scale evaluations of applications that address the most critical crash scenarios.

In August, Toyota and seven other automakers completed a year-long connected vehicle pilot program with U.S. DOT in Michigan. The model deployment, which included nearly 3,000 DSRC vehicles, demonstrated vehicle to vehicle applications in real world driving scenarios and verified the maturity and stability of the standards. The results from the pilot are expected to inform a regulatory decision by the agency of DSRC technology by the end of this year.

As you are well aware, the FCC issued an NPRM earlier this year that solicited comments on opening the 5.9 gigahertz spectrum to unlicensed devices. Toyota is not conceptually opposed to sharing the spectrum and believes that it may be possible for DSRC and unlicensed devices to coexist in the band. However, we also believe that the creation of a sharing framework, or the implementation of sharing rules, should not be considered unless and until, one, a viable sharing spectrum sharing technology is identified and, two, rigorous testing verifies that there is no harmful interference from unlicensed devices.

Interference that results in delayed or missed driver warnings will undermine the system's entire foundation, rendering it essentially useless and putting the future of DSRC technology in the United States at risk. Although we are strongly committed to it, the automobile industry cannot responsibly deploy safety of life, DSRC technology, unless the possibility of harmful interference from unlicensed devices is ruled out.

Toyota is committed to helping validate a technical sharing solution once one has been identified. We have been actively engaged with the Wi-fi community and other stakeholders who are exploring possible sharing solutions that alleviate any risk of harmful interference from unlicensed devices. But we are not there yet, and it is going to take more time to see if we can get there. Until then, the FCC should refrain from taking any further action in the 5.9 gigahertz band.

Thank you. I look forward to your questions.

[The prepared statement of Mr. Kenney follows:]

Statement of  
John Kenney  
Principal Researcher  
Toyota InfoTechnology Center, U.S.A., Inc.  
on  
“Challenges and Opportunities in the 5 GHz Spectrum Band”

before the  
U.S. House of Representatives  
Committee on Energy and Commerce  
Subcommittee on Communications and Technology

November 13, 2013

Chairman Walden, Ranking Member Eshoo, and other Members of the Subcommittee, thank you for the opportunity to testify before you this morning. And thank you for holding this important hearing on the challenges and opportunities in the 5 GHz band.

My name is John Kenney. I am Principal Researcher at the Toyota InfoTechnology Center in Mountain View, California, where I lead our vehicular networking research team. I help represent Toyota in the Vehicle Safety Communications consortium, which performs pre-competitive research in cooperation with the U.S. Department of Transportation (U.S. DOT). I also represent Toyota in vehicle communication standards bodies in the United States and in Europe, and have been recognized by the IEEE Standards Association for contributions to the development of vehicular communication standards.

Toyota recognizes and fully appreciates that there is a spectrum crunch and that we must find new and innovative ways to maximize the effective use of the limited spectrum that is available. We have been – and continue to be – generally supportive of efforts to open up more spectrum for unlicensed uses. In principle, we also support the prospect of sharing spectrum with unlicensed devices in the 5.9 GHz band if it can be proven that no harmful interference will impair the safety-of-life mission for which that spectrum is allocated.

**What is Dedicated Short-Range Communication (DSRC)?**

There have been remarkable advances in the crashworthiness of vehicles in recent years, resulting in an impressive reduction in traffic casualties and fatalities. Despite this, however, tens of thousands of people are still dying in traffic accidents each year in the United States. Toyota and the automobile industry firmly believe that the next great opportunity to reduce

injuries and fatalities from traffic accidents rests with the deployment of innovative new technologies that will prevent crashes in the first place.

Companies like Toyota are leading the way by outfitting vehicles with top-of-the-line sensors, radars, and cameras that can identify and notify drivers of potential hazards. However, these existing technologies have important limitations with respect to range, field-of-view, and line-of-sight. Vehicle-to-vehicle and vehicle-to-infrastructure communication is the technology that will allow us to overcome these challenges by allowing vehicles to identify collision threats at a greater distance or with a vehicle that is around a corner or behind a truck. The complementary combination of this communication technology and on-board sensors is critical to making significant progress towards our ultimate goal of zero casualties from traffic accidents.

Dedicated short-range communication, or DSRC, is such a technology. DSRC is a two-way, short- to medium-range wireless communication capability that allows vehicles to communicate with each other to detect and avoid hazards. DSRC-equipped vehicles broadcast precise information - such as their location, speed, and acceleration - several times per second over a range of a few hundred meters. Other vehicles outfitted with DSRC technology receive these "messages" and use them to compute the trajectory of each neighboring vehicle, compare these with their own predicted path, and determine if any of the neighboring vehicles pose a collision threat. This DSRC-enabled vehicle-to-vehicle communication capability paves the way for the next-generation of lane departure and forward collision warnings, sudden braking ahead warnings, do not pass warnings, intersection collision avoidance systems, and approaching emergency vehicle notifications.



DSRC vehicles can also communicate with DSRC-equipped roadside infrastructure, enabling additional information to be provided to drivers. This includes information about the potentially unique layout of an approaching intersection or road, the current and future state of upcoming traffic signals, and the existence of a potential hazard such as ice, fog, a disabled vehicle, a bicyclist, or a pedestrian.

If a DSRC-enabled vehicle determines that a potential collision or other hazard exists, the on-board system can warn the driver or, in some instances, take action to avoid an accident. Feedback to the driver can be conveyed audibly, visually through a heads up display, dashboard screen, or other signal, or through a haptic mechanism (such as a shaking steering wheel or vibrating seat) and can be formulated to range in intensity based on the risk.

In a 2010 report entitled *Frequency of Target Crashes for IntelliDrive Safety Systems*, the National Highway Traffic Safety Administration (NHTSA) concluded that connected vehicle technology – including both vehicle-to-vehicle and vehicle-to-infrastructure communication – has the potential to address scenarios accounting for approximately 80 percent of crashes involving non-impaired drivers. Specifically, NHTSA research showed that the technology could help prevent a majority of the types of crashes that typically occur in the real world, such as crashes at intersections or while changing lanes. NHTSA’s analysis of communication alternatives also found that DSRC at 5.9 GHz is “the only communication option at this time capable of effectively and reliably providing this safety-of-life capability”.

It is important to note that, although our initial focus is on safety applications, DSRC can – and almost certainly will – be used for many other applications beyond collision avoidance and

related safety purposes. For example, DSRC can be used to assist with navigation, to make electronic payments (tolls, parking, fuels, etc.), to improve fuel efficiency through speed pacing at traffic lights, or to gather and disseminate real-time traffic information. In addition, just as the Internet has moved far beyond its original limited email and file transfer applications, DSRC is also likely to unleash creative and innovative connected car applications that go far beyond the immediate safety benefits that I am focusing on today. I have no doubt that DSRC will save lives, improve the environment, create jobs, and help the United States to maintain technical leadership in a field that will be an important contributor to economic growth in the future.

**What is the Current Status of DSRC Technology?**

I recognize that there may be some skepticism about DSRC technology and concerns that the benefits are being overstated or that the automakers will never bring the technology to the market. I can assure you that Toyota believes in and is committed to DSRC as a critical safety technology. In fact, we have already commercialized first-generation DSRC technology, and recently announced plans to commercialize second-generation DSRC, in other markets and would like to bring this technology to drivers of our vehicles here in the near future.

We are not alone on this. As you are aware, in 1999, the Federal Communications Commission (FCC) allocated 75 MHz of spectrum in the 5.9 GHz band to be used for DSRC. In 2003, the Commission adopted the licensing and service rules for DSRC systems operating in the band. Since then, U.S. DOT has been conducting research and field testing with Toyota and other automobile companies to demonstrate feasibility and to prepare for widespread deployment of crash avoidance systems that use vehicle-to-vehicle and vehicle-to-infrastructure

communication. At this point, pre-production prototypes have been developed by a number of automobile companies, including Toyota, and are currently supporting demonstrations and large-scale evaluations of the applications that address the most critical crash scenarios.

During this time, work has been underway to develop the common technical standards for 5.9 GHz DSRC technology. In 2010, this work resulted in IEEE approving the 802.11p Wireless Access in Vehicular Environments (WAVE) amendment to the 802.11 standard for wireless local area networks (WLAN). Other core DSRC standards were also published in 2009 and 2010 by IEEE and SAE International.

In addition, in August of this year, Toyota and seven other automakers, including Ford, General Motors, Volkswagen, and Mercedes Benz, completed a year-long connected vehicle pilot program with U.S. DOT in Ann Arbor, Michigan. The Model Deployment, which included nearly 3,000 vehicles outfitted with DSRC technology from different manufacturers, demonstrated vehicle-to-vehicle applications in real-world driving scenarios and verified the maturity and stability of the standards. The results from the pilot program are currently being analyzed and assessed by NHTSA and are expected to inform a long-anticipated regulatory decision by the agency on the use of DSRC technology in future vehicles by the end of this year.

Automakers in the United States have been leading the way in the development of DSRC technology over the last decade. However, progress on DSRC is now occurring around the globe and American innovation in this area is being challenged. For example, in 2012, twelve automakers announced commitments to deploy vehicle-to-vehicle communication based on the IEEE 802.11p standard in the European Union by 2015. If the United States weakens its

commitment to this technology in the final stretch, it will likely cede its leadership and the economic benefits of being the first to deploy the technology on an industry-wide basis will be lost to other regions.

**What Does the FCC's Notice of Proposed Rulemaking Mean for DSRC?**

As you are well aware, the FCC issued a Notice of Proposed Rulemaking earlier this year that solicited comments on opening the 5.9 GHz band to use by unlicensed devices.

Toyota is not conceptually opposed to sharing the 5.9 GHz spectrum with unlicensed devices and believes that it may be possible for DSRC and unlicensed devices to co-exist in the band. However, we also believe that the creation of a sharing framework, or the implementation of sharing rules, should not occur unless and until: (1) a viable spectrum sharing technology is identified; and (2) testing verifies that there is no harmful interference from unlicensed devices. Interference that results in delayed or missed driver warnings will undermine the system's entire foundation, rendering it essentially useless and putting the entire future of DSRC technology in the United States at risk. Although we are strongly committed to the technology, the automobile industry cannot responsibly deploy "safety-of-life" DSRC technology unless the possibility of harmful interference from unlicensed devices is ruled out.

In our opinion, Congress made an important and correct distinction in the *Middle Class Tax Relief and Job Creation Act* as it relates to the 5 GHz band. As you are aware, the law expressly required the FCC to initiate a proceeding to allow unlicensed devices to operate in the 5350-5470 MHz band. By contrast, there was no requirement by Congress for the FCC to initiate a proceeding to allow unlicensed devices in the 5.9 GHz band. Instead, the law required only that

the National Telecommunications and Information Administration (NTIA), in consultation with other affected agencies, conduct a study to evaluate known and proposed spectrum sharing technologies and the risk to federal users if unlicensed devices were permitted. We believe that this Congressional distinction is critical and correctly supports the notion that further steps need to be taken before any kind of sharing regime is imposed in the 5.9 GHz band.

As you are likely aware, the preliminary NTIA study identified specific risk elements with respect to the co-existence of unlicensed devices with DSRC systems in the 5.9 GHz band. The study concluded that more work needed to be done to understand the challenges before the agency could conclude that the band can be safely opened up to Wi-Fi or other unlicensed use. The NTIA has stated its intent to finalize recommendations on the suitability of the band for unlicensed device operation by the end of next year.

The truth is that, as NTIA confirmed, there are unique technical challenges to sharing in the 5.9 GHz band that cannot be ignored. For example:

- Unlicensed devices currently operating in some other bands detect primary users whose position is most often fixed, such as in the case of radar installations. In these cases, a geolocation database of primary user locations may be sufficient to establish certain areas as safe for unlicensed operation. By contrast, DSRC devices are inherently mobile and can operate almost anywhere.
- Unlicensed signal detection technologies were not designed to detect, and may not actually be capable of detecting, DSRC signals.

- Wi-Fi devices currently detect a transition from a channel that is idle to one that is busy based on a 20 MHz Clear Channel Assessment (CCA) function. In contrast, DSRC signals use a 10 MHz channel. As a result, in order for CCA-based DSRC detection to be successful, a Wi-Fi device would need dedicated 10 MHz CCA detectors.
- DSRC channel access protocols were not designed with the co-existence of other wireless devices in mind and are not compatible with existing Wi-Fi channel access protocols. For sharing to be possible, it may be necessary for Wi-Fi devices to operate in the 5.9 GHz band only in places and at times when it can reliably be determined that DSRC devices are not present.

Toyota is committed to helping to validate a technical sharing solution in the 5.9 GHz band once one has been identified. We have been actively engaged with the Wi-Fi community and other stakeholders who are exploring possible sharing solutions that will alleviate any risk of harmful interference from unlicensed devices. We are also active and engaged members of the recently established Tiger Team through IEEE that is working on possible paths forward on this issue.

But we're not there yet and it's going to take a bit more time to see if we can get there. For now, the good faith efforts that are underway between the automobile companies, the Wi-Fi community, the FCC, the NTIA, and the U.S. DOT should be allowed to proceed. Let the stakeholder community continue to work together to determine the feasibility of sharing between unlicensed devices and DSRC systems.

In the meantime, we encourage the FCC to move forward with its proceedings to open up other bands of spectrum for unlicensed uses, including those within the 5 GHz band, if that is determined to be appropriate. Our request for further evaluation and deliberation applies only to the 5.9 GHz band.

Thank you, again, for the opportunity to testify before you today. We are pleased that the Committee is taking an active interest in developments within the 5 GHz band, and appreciate your willingness to fully explore both the challenges and opportunities that exist. I look forward to your questions.

JOHN KENNEY  
Toyota InfoTechnology Center, U.S.A., Inc.  
Summary of Written Statement

Toyota recognizes and fully appreciates that there is a spectrum crunch and that we must find new and innovative ways to maximize the effective use of the limited spectrum that is available.

Toyota and the automobile industry firmly believe that the next great opportunity to reduce injuries and fatalities from traffic accidents rests with the deployment of innovative new technologies that will prevent crashes in the first place. Dedicated short-range communication, or DSRC, is such a technology.

Toyota believes in and is committed to DSRC as a critical safety technology. We have already commercialized first-generation DSRC technology, and recently announced plans to commercialize second-generation DSRC, in other markets and would like to bring this technology to drivers of our vehicles here in the United States in the near future.

U.S. DOT has been conducting research and field testing with Toyota and other automobile companies to demonstrate feasibility and to prepare for widespread deployment of crash avoidance systems that use vehicle-to-vehicle and vehicle-to-infrastructure communication. At this point, pre-production prototypes have been developed by a number of automobile companies, including Toyota.

Toyota is not conceptually opposed to sharing the 5.9 GHz spectrum with unlicensed devices and believes that it may be possible for DSRC and unlicensed devices can co-exist in the band. However, we also believe that the creation of a sharing framework, or the implementation of sharing rules, should not occur unless and until: (1) a viable spectrum sharing technology is identified; and (2) testing verifies that there is no harmful interference from unlicensed devices.

Toyota is committed to helping to validate a technical sharing solution in the 5.9 GHz band once one has been identified. We have been actively engaged with the Wi-Fi community and other



stakeholders who are exploring possible sharing solutions that will alleviate any risk of harmful interference.

Mr. WALDEN. Mr. Kenney, thank you for testifying. We will now turn to Mr. Nagel. Tom Nagel is the Senior Vice President of Business Development at Comcast. Mr. Nagel, thank you for being with us. And please, go ahead.

#### STATEMENT OF TOM NAGEL

Mr. NAGEL. Chairman Walden, Ranking Member Eshoo and members of the subcommittee, thank you for the opportunity to testify. I am pleased to discuss the many benefits of Wi-fi and how the 5 gigahertz band is critical to ensuring Wi-fi continues to serve as a platform for innovation, investment and economic growth, all without harming incumbent users.

At Comcast, one of my primary responsibilities has been the strategic development of our wireless efforts, and in particular our Wi-fi efforts. Comcast operates a Wi-fi network that has expanded exponentially in less than 2 years, from 5,000 access points last year to nearly 350,000 access points today. We have also partnered with other cable operators to give our customers access to more than 100,000 hotspots, with many more to come.

My experience in building and operating Comcast networks shows me firsthand the important role that Wi-fi plays in the broadband marketplace. Consumers use Wi-fi for cost effective and robust wireless access to the Internet. And various studies confirm that unlicensed services like Wi-fi contribute tens of billions of dollars in economic value each year.

Wi-fi networks have also proven to be valuable during emergencies. In the aftermath of Hurricane Sandy last year and the attack of the Boston Marathon this year, licensed wireless networks were temporarily overloaded or down completely. In both cases, Comcast opened its Wi-fi network to provide free access to anybody with a Wi-fi enabled device so that people could receive urgent information and communicate with loved ones. All consumers with a Wi-fi enabled device can use Wi-fi, regardless of their wireless carrier. So it is a powerful and flexible tool in emergencies.

However, two challenges stand in the way of its continued growth. First, the spectrum used in Wi-fi today is severely congested, especially in densely populated areas. And without quick action, consumers will begin to experience reduced Wi-fi performance. To address this problem, we must ensure there is sufficient unlicensed spectrum to meet growing consumer demand. The 5 gigahertz band is critical to this effort. Second, the next generation of Wi-fi, often called gigabit Wi-fi, requires larger channels than are currently available and technical rules that facilitate reasonable deployments. Gigabit Wi-fi can only be done in the 5 gigahertz band. If we fail to make the necessary changes, we risk falling behind other nations that will deploy the next generation of Wi-fi.

Fortunately, Congress, the Administration and the FCC have already taken steps towards addressing these challenges. Comcast commends Congress and this committee for passing the Spectrum Act of 2012 which specifically identified the 5 gigahertz band as a powerful and unique resource for Wi-fi. And we strongly support the FCC's implementation efforts. The FCC has proposed two unlicensed bands in the 5 gigahertz and sensible changes to existing bands. These improvements are essential to relieving the existing

Wi-fi congestion and providing enough spectrum to support gigabit Wi-fi.

Importantly, under the FCC's proposals, Wi-fi will be able to share the 5 gigahertz band without causing harmful interference to existing users. This approach maximizes the value of spectrum for all Americans. Although portions of the 5 gigahertz band may present complicated technical issues, in some sub-bands, the FCC has a clear path to move forward now. Specifically, the FCC should adopt its proposed rule changes in the UNII-1 band, which would make 100 megahertz available for Wi-fi almost immediately. Importantly, the Department of Defense recently announced it does not need access to UN81. That means that just one company uses all 100 megahertz for a small group of customers. And technical studies have shown that proposed rule changes would not cause harmful interference to the incumbent in the band. And this should be our top near-term priority.

Comcast is also enthusiastic about expanding Wi-fi operations to the UNII-4 band. We have reached out to the ITS companies to find a sharing solution that protects ITS and allows for Wi-fi investment. Now is the perfect moment to do so because there are no commercially deployed ITS vehicles using the 5 gigahertz band. We are willing to be flexible to ensure that ITS is protected. We ask that the ITS interests also agree to be flexible.

There is a solution to be had. The days where incumbents can hold exclusive rights to unutilized or underutilized spectrum have long since passed. Wi-fi services in the 5 gigahertz band will offer enormous economic benefits and social benefits. Comcast is committed to working with Congress, the Administration, the FCC and incumbents to reach solutions that will maximize the value of the 5 gigahertz band to this Nation. Thank you, and I look forward to your questions.

[The prepared statement of Mr. Nagel follows:]

**TESTIMONY OF  
THOMAS F. NAGEL  
SENIOR VICE PRESIDENT  
COMCAST CORPORATION**

**BEFORE THE  
U.S. HOUSE COMMITTEE ON ENERGY AND COMMERCE  
SUBCOMMITTEE ON COMMUNICATIONS AND TECHNOLOGY**

**HEARING ON  
"CHALLENGES AND OPPORTUNITIES IN THE 5 GHZ SPECTRUM BAND"**

**NOVEMBER 13, 2013**

Mr. Chairman and Members of the Subcommittee:

Thank you for inviting me to testify today. I am the Senior Vice President of Strategic Initiatives at Comcast Corporation ("Comcast"), where I have worked since 2002. In my current role, I am responsible for leading the strategic development of Comcast's wireless services and products.

Comcast believes that the 5 GHz band has enormous potential to support continued growth in unlicensed wireless services, including the next generation of Wi-Fi. The 5 GHz band is a platform for technological innovation, investment, and economic growth. With access to additional 5 GHz spectrum and improved Federal Communications Commission ("FCC") rules, our industry will be able to use this band to meet growing consumer demand for wireless data services.

Over the last few years, Comcast has implemented an innovative strategy to provide broadband services to our customers outside the home using our Wi-Fi network to deliver wireless services that operate over the 2.4 GHz and 5 GHz bands. We have deployed a network of nearly 350,000 Xfinity WiFi access points throughout our footprint, accessible for no additional charge to qualified Comcast broadband customers via any Wi-Fi-enabled device. Our customers have embraced this service, logging on more than four million times and transferring more than 70 terabytes (or 70,000 gigabytes) of data every week. And we are partnering with other cable companies to offer one of the country's largest networks of Wi-Fi access points, giving our customers access to more than 100,000 additional access points around the country. This substantial investment allows us to successfully extend our existing network in ways that make it more flexible, more interoperable, and more convenient for our customers. But continued investment and innovation depends on access to additional unlicensed spectrum resources.

Our experience confirms that unlicensed technologies are a central component of the wireless landscape, and are among the most popular methods consumers use to access the Internet. Unlicensed spectrum provides a platform for devices and services that contribute tens of billions of dollars of value to the nation's economy every year. Americans' demand for wireless data services continues to grow, regardless of whether they are at home or on the go, and unlicensed services like Wi-Fi play a key role in meeting that demand. In addition, unlicensed services serve as critical sources of connectivity in times of crisis when licensed wireless networks may

not be able to support heavy traffic loads or are otherwise unavailable, such as when Comcast's Wi-Fi networks facilitated communications in the aftermath of Hurricane Sandy last year and the attack at the Boston Marathon earlier this year.

Our nation's spectrum policy must reflect these realities by addressing the current and future challenges to the continued growth of unlicensed services. As FCC Chairman Wheeler said just last week, "[w]e must make sure that unlicensed spectrum is a key part of whatever set of decisions that we make . . . [because] . . . [u]nlicensed spectrum has been and must continue to be the catalyst for innovation."<sup>1</sup>

It is undisputed that the future of Wi-Fi is in the 5 GHz band. The core challenge we face today is that Wi-Fi spectrum in the 2.4 GHz band has become highly congested, especially in densely populated urban areas. This makes it harder for service providers to deliver the wireless broadband services that consumers and businesses expect and, in many cases, need. Solving this problem requires a balanced approach. The FCC should allocate additional spectrum in the 5 GHz band for unlicensed use *and* remove regulatory roadblocks that limit the efficient use of already-allocated unlicensed spectrum, such as unnecessary indoor-only restrictions, power limitations, and other technical requirements that act as barriers.

Making additional spectrum available for Wi-Fi in the 5 GHz band and making that band more usable are also essential to deploying gigabit Wi-Fi in the United States. Gigabit Wi-Fi depends on the newest Wi-Fi standard – 802.11ac – which requires wider channels than current unlicensed bands can support. We have urged the FCC to allow higher power levels and outdoor use in the U-NII-1 band and to open the U-NII-2b and U-NII-4 bands for unlicensed operations. Doing this would ease congestion in other bands and ensure that the United States has unlicensed bands large enough to support gigabit Wi-Fi. The 5 GHz band is uniquely important to the future of Wi-Fi because many devices are already compatible with 5 GHz Wi-Fi technologies. Simply put, there are no other suitable spectrum bands that could realistically support the next generation of Wi-Fi.

Allocating additional spectrum to unlicensed services does not mean that incumbent users of the 5 GHz band must be displaced. Technical studies submitted to the FCC are clear that the FCC can move ahead in ways that will allow effective sharing of the spectrum, particularly in the U-NII-1 and U-NII-4 bands. While incumbent users are entitled to protection from harmful interference, they should not be allowed to block forward progress – especially when such incumbents have not yet deployed commercially available services. In an era of spectrum scarcity and increasingly efficient wireless technologies, the country cannot afford to allow huge swaths of spectrum to remain unused or underused because incumbents refuse to share or refuse to work together to make more efficient use of spectrum. Unlicensed services like Wi-Fi are designed to *share* spectrum with other users, and technological solutions can permit Wi-Fi and other unlicensed technologies to co-exist with incumbent users without undermining incumbents' use of the spectrum.

Congress understands this and embraced a balanced spectrum policy that took a significant step toward addressing the challenges facing both licensed and unlicensed wireless services when it

<sup>1</sup> See Kate Tummarello, *FCC Chief Touts Importance of Wi-Fi Airwaves*, Hillicon Valley (Nov. 8, 2013), <http://thehill.com/blogs/hillicon-valley/189697-fcc-chief-touts-importance-of-wi-fi-airwaves>.

passed the Middle Class Tax Relief and Job Creation Act of 2012, which paved the way for action in the 5 GHz band. Comcast applauds Congress for passing this landmark legislation, and we appreciate the efforts of the FCC, National Telecommunications and Information Administration ("NTIA"), and other interested parties.

We ask now that Congress encourage the FCC and NTIA to expeditiously adopt new rules before existing unlicensed bands become completely saturated. Timely action will promote investment in this band and enable the development of the next generation of unlicensed technologies.

# **I. UNLICENSED 5 GHz SPECTRUM PROVIDES A PLATFORM FOR INVESTMENT, INNOVATION, AND ECONOMIC GROWTH.**

Consumers today expect access to content and information anytime, anywhere, and on any device, and unlicensed spectrum has been a key catalyst to this revolution. The explosive growth of services and devices using unlicensed spectrum, including Wi-Fi, Bluetooth, RFID, and smart grid applications, among many others, has been remarkable. These services have greatly benefitted consumers, created billions of dollars of economic value, created and supported millions of jobs, and provided a platform for even more innovation and investment.<sup>2</sup> Wi-Fi in particular is now a part of most Americans' daily lives and a service upon which consumers and businesses – including mobile network operators – increasingly rely for cost-effective and robust wireless broadband access to the Internet. In light of the extremely positive economic and societal effects of unlicensed services, it is no surprise that there is widespread consensus among policymakers,<sup>3</sup> industry,<sup>4</sup> and other interested parties<sup>5</sup> that unlicensed services must continue to

<sup>2</sup> The unlicensed model reduces regulatory and economic barriers to use of the spectrum, thereby "encouraging a deluge of technological and business model innovation" and turning unlicensed spectrum "into the most economically productive radio spectrum in the world." Richard Thanki, *The Power of the Unlicensed Economy*, AllThingsD, July 10, 2012, available at <http://allthingsd.com/20120710/the-power-of-the-unlicensed-economy/> ("Thanki 2012 Paper").

<sup>3</sup> See, e.g., Presidential Memorandum: Unleashing the Wireless Broadband Revolution (June 28, 2010) (ordering the Secretary of Commerce to make spectrum available for, *inter alia*, "shared access by commercial and Government users in order to enable licensed or unlicensed wireless broadband technologies to be deployed.") (emphasis added), available at <http://www.whitehouse.gov/the-press-office/presidential-memorandum-unleashing-wireless-broadband-revolution>; Press Release, Energy & Commerce Comm., U.S. House of Representatives, *Walden, Latta Welcome Progress on Efforts to Increase Unlicensed Spectrum* (Jan. 10, 2013), available at <http://energycommerce.house.gov/press-release/walden-latta-welcome-progress-efforts-increase-unlicensed-spectrum>; Press Release, FCC, *Statement from FCC Chairman Julius Genachowski on House Passage of Voluntary Incentive Auction Legislation* (Dec. 13, 2011) ("Unlicensed spectrum stimulates innovation, investment, and job creation in many ways, including by providing start-ups with quick access to a testbed for spectrum that is used by millions, bringing new technologies to consumers in a rapid fashion."); *Unlicensed Operation in the TV Broadcast Bands*, Second Report and Order and Memorandum Opinion and Order, 23 FCC Rcd. 16807 (2008) (Statement of Commissioner Robert McDowell) ("Robust unlicensed use of white spaces will give nimble entrepreneurs the freedom to disrupt the market in positive and constructive ways that will force incumbents to keep pace with this new revolution.");

<sup>4</sup> See, e.g., Comments of Motorola Solutions, Inc., ET Docket No. 13-49, at 8 (May 28, 2013) ("There is a well-documented need for additional wireless broadband spectrum, and unlicensed spectrum in particular is a key driver of innovation and economic development."); Comments of Time Warner Cable, Inc., ET Docket No. 13-49, at 4 (May 28, 2013) ("TWC believes that a robust Wi-Fi capability provides an important complement to its existing wireline broadband network to enable its subscribers to access the Internet anywhere, anytime, on any device."); Reply Comments of Sprint Nextel Corp., WT Docket No. 12-4, at 10 (Mar. 26, 2012) ("Wi-Fi networks that are

be a key component of wired and wireless broadband Internet access services. Comcast has first-hand experience with the tremendous value these services offer to consumers.

**A. Comcast's Xfinity WiFi Service Uses Unlicensed Spectrum to Deliver Fast, Reliable Wireless Broadband Access.**

Comcast's residential and business customers have long used Wi-Fi routers in their homes and businesses to enhance the value of their wired high-speed Internet service. Over the last few years, Comcast has invested significant human and capital resources to bring that experience *outside* the home by deploying a robust Wi-Fi network that enables our customers to enjoy wireless Internet access on the go. Today, Comcast makes Xfinity WiFi available in several cities throughout the country for any consumer to access on a pay-per-use basis, and access is included for no additional charge for qualifying Xfinity Internet customers.

Comcast's efforts are really only beginning. In 2012, we expanded the Xfinity WiFi network from approximately 5,000 access points to more than 25,000 access points. So far this year, that number has increased to nearly 350,000 access points, as we have ramped up the deployment of our network, enhancing the service in existing areas and expanding into several new regions, including Washington, D.C. We are rolling out a new neighborhood hotspot initiative that has the potential to add millions of additional Wi-Fi access points throughout our footprint, thereby significantly enhancing consumers' ability to stay connected.<sup>6</sup> Through our CableWiFi partnership with other cable operators, our customers have access to more than 100,000 additional access points throughout the country for no additional charge.<sup>7</sup> Importantly, all of our outdoor access points – and all the outdoor access points installed by our cable partners – include the ability to access the 5 GHz band.

Usage of Xfinity WiFi has grown dramatically as we have expanded its footprint. There are now more users of the Xfinity WiFi service than ever before, and they are doing more, more often, with more devices, for longer. In fact, our Wi-Fi network now carries between 70-90 terabytes of data every week, which roughly equates to a staggering 300,000 gigabytes of data every month. We support more than four million user sessions every week, and these figures are steadily increasing. Comcast now records more Wi-Fi user sessions in a single month than it did in the first two-and-a-half years of the Xfinity WiFi project.

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easily – even seamlessly – accessible by customers of wireless carriers can provide users with advantages of higher-speed connections without wireless data limits.”); Joint Comments of Google, Inc. & Microsoft, Inc., GN Docket No. 12-268, at 1 (Jan. 25, 2013) (“[B]usinesses depend on access to robust licensed services as well as access to robust unlicensed spectrum resources. One without the other simply will not allow U.S. businesses to meet accelerating consumer demand for wireless products and services.”).

<sup>5</sup> See, e.g., Mark Cooper, *Efficiency Gains and Consumer Benefits of Unlicensed Access to the Public Airwaves* 7 (Jan. 2012), available at [www.markcooperresearch.com/SharedSpectrumAnalysis.pdf](http://www.markcooperresearch.com/SharedSpectrumAnalysis.pdf) (“The unlicensed model has succeeded in supporting a large amount of economic activity in the wireless broadband space by bringing new and unique services to the market, increasing the value of broadband service by extending it to additional devices, and providing a lower cost, more efficient avenue to deliver data to consumers.”).

<sup>6</sup> Tom Nagel, “The Evolution of Xfinity WiFi,” ComcastVoices.com (June 10, 2013).

<sup>7</sup> See generally CableWiFi™, <http://www.cablewifi.com/> (last visited Sept. 27, 2013).

**B. Unlicensed Services Add Significant Value to Mobile and Fixed Broadband Services and the National Economy.**

Comcast's experience is consistent with the growing body of data showing that unlicensed services create huge benefits both for consumers and broadband providers and support significant growth in the economy as a whole.

According to a 2012 study, "a variety of approaches all point toward economic benefits [from unlicensed technologies] at least in the tens of billions of dollars a year."<sup>8</sup> A separate 2012 study concluded that the extension of fixed broadband networks using unlicensed spectrum generates approximately \$15.5 billion of consumer surplus in the United States every year.<sup>9</sup> And the value of in-home Wi-Fi, hospital Wi-Fi, and RFID tags "together may generate \$16-37 billion per year in economic value for the U.S. economy over the next 15 years."<sup>10</sup> By some accounts, unlicensed services contribute upwards of \$50 billion in annual economic growth.<sup>11</sup>

Unlicensed spectrum also adds value as a key complement to licensed wireless technologies, particularly as part of the solution to the rising demand for licensed spectrum caused by increased mobile wireless broadband traffic. According to Cisco, traffic on licensed mobile wireless networks increased 70 percent last year, rising from 520 petabytes per month in 2011 to over 885 petabytes per month in 2012.<sup>12</sup> Cisco expects that tremendous rate of annual growth to continue for at least the next four years.<sup>13</sup> Many mobile wireless broadband providers have come to recognize that, to keep up with consumers' increasing demand, they will need to rely on unlicensed services to carry some of the load. As Sprint has explained, "[o]ne of the most effective methods of increasing the capacity of wireless data systems is moving data traffic, whenever possible, from the licensed spectrum of commercial mobile carriers to unlicensed spectrum, such as that now used for Wi-Fi."<sup>14</sup>

<sup>8</sup> Paul Milgrom et al., *The Case for Unlicensed Spectrum* ¶ 42 (Oct. 12, 2011), available at [www.stanford.edu/~jdlevin/Papers/UnlicensedSpectrum.pdf](http://www.stanford.edu/~jdlevin/Papers/UnlicensedSpectrum.pdf).

<sup>9</sup> Richard Thanki, *The Economic Significance of License-Exempt Spectrum to the Future of the Internet*, Annex 2 (June 2012), at [http://research.microsoft.com/en-us/projects/spectrum/economic-significance-of-license-exempt-spectrum-report\\_thanki.pdf](http://research.microsoft.com/en-us/projects/spectrum/economic-significance-of-license-exempt-spectrum-report_thanki.pdf).

<sup>10</sup> Richard Thanki, *The Economic Value Generated by Current and Future Allocations of Unlicensed Spectrum*, Final Report, Perspective Associates 42 (Sept. 28, 2009), available at [http://spectrumbridge.com/Libraries/White\\_Space\\_Primer/whitespaces-microsoft-study.sflb.ashx](http://spectrumbridge.com/Libraries/White_Space_Primer/whitespaces-microsoft-study.sflb.ashx).

<sup>11</sup> See, e.g., *Revision of Part 15 of the Commission's Rules to Permit Unlicensed National Information Infrastructure (U-NII) Devices in the 5 GHz Band*, Notice of Proposed Rulemaking, 28 FCC Rcd. 1769 (2013) (Statement of Commissioner Mignon Clyburn).

<sup>12</sup> See Cisco, *Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2012-2017*, at 1 (Feb. 6, 2013) ("2013 Cisco Forecast"), [http://www.cisco.com/en/US/solutions/collateral/ns341/ns525/ns537/ns705/ns827/white\\_paper\\_c11-520862.pdf](http://www.cisco.com/en/US/solutions/collateral/ns341/ns525/ns537/ns705/ns827/white_paper_c11-520862.pdf).

<sup>13</sup> See *id.* at 3.

<sup>14</sup> Comments of Sprint Nextel Corp., WT Docket No. 12-4, at 5 (Feb. 21, 2012); see also Comments of Ericsson, ET Docket No. 13-49, at 2 (May 28, 2013) (discussing importance of technologies that "enable mobile operators to deliver supplemental small cell or stand-alone Wi-Fi" using unlicensed technologies).



The beneficial impact on licensed wireless providers and their customers resulting from Wi-Fi is staggering. The amount of mobile data offloaded to Wi-Fi networks is projected to reach 21 exabytes (or 21 *billion* gigabytes) by 2017.<sup>15</sup> One study concluded that, “[i]n the absence of Wi-Fi, cellular operators would need to construct up to 450,000 new radio base stations to serve increased smartphone data traffic. This could cost \$93 *billion* – subjecting smartphone and tablet users to significantly higher network charges or greatly diminished service.”<sup>16</sup>

There are also positive societal benefits associated with Wi-Fi services that are not as easily quantified, but are readily apparent. This was convincingly demonstrated by Comcast’s experience during the chaotic aftermath of Hurricane Sandy last year, and after the events at the Boston Marathon earlier this year. Following Sandy, mobile wireless service was unavailable for large portions of the affected areas.<sup>17</sup> In the aftermath of the storm, Comcast made approximately 20,000 Xfinity WiFi access points in ten hard-hit states and the District of Columbia available at no charge to anyone who needed them to communicate with family or friends, or otherwise to get important recovery information. Comcast recorded more than 250,000 individual sessions during that period, supporting tens of thousands of unique users while also adding a special functionality to permit non-Comcast subscribers to maintain their connection without having to refresh their credentials. Likewise, in the immediate aftermath of the attack at the Boston Marathon, commercial mobile wireless networks were overloaded,<sup>18</sup> but Comcast opened its network to anyone – including non-Comcast subscribers – with a Wi-Fi-enabled device to establish communications with loved ones, leading to significantly increased usage of our Xfinity WiFi network in Boston and the surrounding communities. In each instance, we opened our Wi-Fi network in full cooperation with federal, state, and local officials as they looked for ways to ease the burdens on affected individuals and public safety officials.

Comcast has opened its Xfinity WiFi network during non-emergencies as well. For example, during the 2012 Summer Olympics, Comcast offered complimentary access to thousands of indoor and outdoor access points in the greater Philadelphia area, allowing anyone with a Wi-Fi-enabled device to follow the Olympic programming from London.<sup>19</sup> Comcast also has offered complimentary access at Xfinity WiFi access points along the New Jersey shore, enabling consumers to conveniently surf the Web, share photos, access social media, and stream music, TV, and movies.<sup>20</sup>

<sup>15</sup> See 2013 Cisco Forecast at 3.

<sup>16</sup> Thanki 2012 Paper (emphasis added).

<sup>17</sup> See, e.g., Brendan Sasso, *FCC Says Hurricane Sandy Knocked Out 25 Percent of Cell Towers in Its Path*, The Hill (Oct. 30, 2012), available at <http://thehill.com/blogs/hillicon-valley/technology/264915-fcc-hurricane-sandy-knocked-out-25-percent-of-cell-towers>.

<sup>18</sup> See, e.g., Chloe Albanesius, *FCC Probes Post-Bombing Cell Phone Congestion in Boston*, PC Magazine (Apr. 17, 2013), available at <http://www.pcmag.com/article2/0,2817,2417891,00.asp>.

<sup>19</sup> See J.T. Ramsay, Comcast Voices Blog, *Comcast Celebrates Live Streaming of the 2012 Olympics Games Through NBCOlympics.com, Offers Free Access to Xfinity WiFi Hot Spots* (July 25, 2012), <http://corporate.comcast.com/comcast-voices/comcast-celebrates-live-streaming-of-the-2012-olympic-games-through-nbcolympicscom-offers-free-access>.

<sup>20</sup> See Joshua Palau, Comcast Voices Blog, *Comcast Creates Lasting Memories this Memorial Day* (May 22, 2013), <http://corporate.comcast.com/comcast-voices/12542>; J.T. Ramsay, Comcast Voices Blog, *Surfing at the*

During emergencies and non-emergencies alike, Wi-Fi networks offer a unique opportunity for consumers to communicate and stay connected because of the accessible nature of unlicensed spectrum and unlicensed services. Almost every mobile device is now equipped with a Wi-Fi radio, so almost everyone can access a Wi-Fi network, regardless of the identity of his or her underlying licensed mobile carrier. Mobile wireless providers simply cannot offer access to everyone, even if they wanted to, because of the closed nature of their networks and the licensed spectrum regime. As a result, in many respects, Wi-Fi has become the interoperable communications standard for consumers.

**II. SOUND SPECTRUM POLICY MUST BE DESIGNED TO ENCOURAGE THE CONTINUED GROWTH OF WI-FI BY MAKING ADDITIONAL 5 GHZ SPECTRUM AVAILABLE FOR UNLICENSED USE AND BY REMOVING UNNECESSARY REGULATORY BARRIERS.**

Although the benefits and importance of unlicensed services like Wi-Fi are clear, there are significant challenges that threaten to impair the growth and development of such services. To meet growing consumer demand and expectations for robust Wi-Fi services, all critical stakeholders – including Congress, the FCC, NTIA, incumbent licensees of the 5 GHz band, and Internet service providers – must address the remaining obstacles in a timely manner.

Comcast has identified two primary objectives that policymakers must achieve to remove the barriers that stand in the way of further growth and innovation in unlicensed services. First, the government must designate new 5 GHz band spectrum for unlicensed use. Because unlicensed services like Wi-Fi are designed to share spectrum with other users, allocating more spectrum to unlicensed often can be achieved without causing harmful interference to incumbents. Second, the government must remove unnecessary regulatory barriers that impede the efficient and intensive use of existing 5 GHz spectrum resources. We believe these are common sense, straightforward approaches that will facilitate the continued growth and vitality of wireless broadband and will return to the public significant benefits in the form of innovation, investment, and economic growth.

In pursuing these objectives, it is important that the FCC not delay acting in those areas where it is able to make a decision more quickly. The FCC has compiled a thorough record in response to its Notice of Proposed Rulemaking (“NPRM”),<sup>21</sup> and we strongly urge the FCC to seize the opportunity to act without further delay with regard to the 5 GHz Unlicensed National Information Infrastructure-1 (“U-NII-1”) sub-band where the record is complete. As Commissioner Pai has stated, “To keep the ball rolling on this [5 GHz proceeding], we should tackle some of the less contentious issues this year.”<sup>22</sup> Commissioner Rosenworcel also has

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*Shore Just Got Easier* (July 1, 2011), <http://corporate.comcast.com/comcast-voices/surfing-at-the-shore-just-got-easier>.

<sup>21</sup> *Revision of Part 15 of the Commission’s Rules to Permit Unlicensed National Information Infrastructure (U-NII) Devices in the 5 GHz Band*, Notice of Proposed Rulemaking, 28 FCC Rcd. 1769 (2013) (“*FCC 5 GHz Notice*”).

<sup>22</sup> *A Review of the President’s Fiscal Year 2014 Funding Request and Budget Justification for the FCC: Hearing Before the Subcomm. on Fin. Servs. and Gen. Gov’t of the S. Comm. on Appropriations*, 113th Cong. (Sept. 11, 2013) (statement of Ajit Pai, Commissioner, FCC), at 3, available at [http://hraunfoss.fcc.gov/edocs\\_public/attachmatch/DOC-323237A1.pdf](http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-323237A1.pdf).

specifically said it is time “to seize this opportunity” to “expand [flexible rules] to this lower portion of the 5 GHz band.”<sup>23</sup> And Commissioner Clyburn has correctly noted that “[t]he sooner we solve these issues, the sooner American innovation can show leadership in developing this band for unlicensed services.”<sup>24</sup>

#### A. A Shortage of Usable Spectrum Hampers the Growth of Unlicensed Services.

Comcast’s experience shows that there is significant congestion in existing unlicensed bands that threatens to stifle economic growth and wireless innovation. Because of this congestion, the core unlicensed spectrum band is already heavily saturated in many densely populated communities. Simply put, congestion in the 2.4 GHz band will make it increasingly difficult for providers to deliver the kinds and quality of service that consumers have come to expect.<sup>25</sup>

The congestion problems in the 2.4 GHz band are well documented. Commissioner Clyburn has pointed out that the 2.4 GHz band is particularly congested in major cities.<sup>26</sup> Former FCC Chairman Genachowski observed that “Wi-Fi congestion is a very real and growing problem.”<sup>27</sup> And former FCC Commissioner McDowell noted, “The spectrum that is used for unlicensed Wi-Fi is also experiencing congestion, which will only increase in the coming years if we do not make appropriate bands, like the 5 GHz band, more attractive for investment and innovation.”<sup>28</sup> A paper recently published by CableLabs, a cable industry non-profit research and development consortium, detailed the spectrum shortage issues:

[A]ny reasonable extrapolation of known trends leads to the conclusion that WiFi spectrum exhaust is a matter of “when,” not “if”. . . . In the absence of new WiFi spectrum, it is likely that wireless broadband consumers will experience reduced performance. This poses a risk to continued growth of the wireless broadband ecosystem, a central element of technology and economic policy in the United States.<sup>29</sup>

<sup>23</sup> Statement of Jessica Rosenworcel, Commissioner, FCC, *Revision of Part 15 of the Commission’s Rules Regarding Operation in the 57-64 GHz Band* (Aug. 9, 2013), available at [http://hraunfoss.fcc.gov/edocs\\_public/attachmatch/FCC-13-112A3.pdf](http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-13-112A3.pdf).

<sup>24</sup> *FCC 5 GHz Notice* (Statement of Commissioner Mignon Clyburn).

<sup>25</sup> “WiFi congestion will only accelerate as the number of wireless devices continues to grow. Without additional spectrum, wireless consumers are likely to experience reduced performance, threatening the future of the wireless ecosystem.” Dirk Grunwald & Kenneth Baker, *FCC Broadcast Incentive Auction: A Band Plan Framework for Maximizing Spectrum Utility* 11 (2013) (attached to Reply Comments of Nat’l Cable and Telecomms. Ass’n, GN Docket No. 12-268 (Mar. 12, 2013)); see also InterDigital, *Dynamic Spectrum Management* 8 (Oct. 2012), available at [http://www.interdigital.com/wp-content/uploads/2012/10/InterDigital-DSM-White-Paper\\_Oct2012.pdf](http://www.interdigital.com/wp-content/uploads/2012/10/InterDigital-DSM-White-Paper_Oct2012.pdf) (“Wi-Fi currently operates in the unlicensed bands 2.4 and 5.0 GHz. . . . Wi-Fi bands are often congested, particularly in high traffic public areas.”).

<sup>26</sup> *FCC 5 GHz Notice* (Statement of Commissioner Mignon Clyburn).

<sup>27</sup> *FCC 5 GHz Notice* (Statement of Chairman Julius Genachowski).

<sup>28</sup> *FCC 5 GHz Notice* (Statement of Commissioner Robert McDowell).

<sup>29</sup> See Rob Alderfer, CableLabs, *WiFi Spectrum: Exhaust Looms* 5 (May 28, 2013) (included as Attachment A to Comments of Nat’l Cable & Telecomms. Ass’n, ET Docket No. 13-49 (May 28, 2013)) (“*WiFi Spectrum: Exhaust Looms*”).

Essentially, there are so many devices using unlicensed spectrum in the 2.4 GHz band in certain locations that the result is significantly reduced Wi-Fi performance.<sup>30</sup> Further growth in data consumption via unlicensed technologies simply cannot occur unless service providers have access to more unlicensed spectrum. Time is of the essence.

#### **B. CHANGES TO THE 5 GHZ BAND ARE CRITICAL TO ENSURING THE CONTINUED VIABILITY OF WI-FI.**

Congress understands the potential of the 5 GHz band to address these challenges. The Spectrum Act directed the FCC to launch a proceeding to modify Part 15 of the FCC's rules to allow U-NII devices to operate in the 5.350-5.450 GHz band, and directed the NTIA to begin the process of allowing more intense sharing of the 5.350-5.450 GHz and 5.850-5.925 GHz bands between incumbent users and unlicensed services like Wi-Fi.<sup>31</sup> On February 20, 2013, the FCC issued an NPRM that would allow unlicensed devices to share these bands with existing users, and, critically, would update and improve the rules that govern the existing 5 GHz unlicensed bands.<sup>32</sup> Comcast commends Congress, NTIA, and the FCC for taking the necessary and significant first steps toward ensuring the availability of sufficient spectrum to encourage the continued growth, development, and proliferation of unlicensed wireless services.

As Comcast explained in our comments to the FCC, the 5 GHz band represents a crucial resource as the FCC works to alleviate the dramatic shortage in spectrum available for unlicensed services.<sup>33</sup> In addition, the 5 GHz band is the only band available for unlicensed services that can accommodate sufficiently wide channels to allow providers like Comcast to deploy the next generation of Wi-Fi. This standard will allow dramatically faster broadband speeds, potentially up to or in excess of one gigabit per second.<sup>34</sup> In contrast to networks using prior standards, Wi-Fi networks operating on the 802.11ac standard will support multiple data-intensive uses, such as several users simultaneously streaming HD videos, without any appreciable degradation in quality.<sup>35</sup> To realize its potential, however, this standard requires 160 megahertz-wide channels – far wider than channels currently available with reasonable operating rules in any of the spectrum bands used for unlicensed use.

Unfortunately, the rules that currently govern the 5 GHz band significantly undermine investment today and prevent providers from realizing the wide-band channels we will need to

<sup>30</sup> See, e.g., John Cox, *Wi-Fi Devices Crowd 2.4 GHz Band; IT Looks to 5 GHz Band*, Network World (Oct. 24, 2011), <http://www.networkworld.com/news/2011/102411-wifi-unbalanced-252237.html> (“The 2.4 GHz band is congested, a symptom of the number of devices that only operate on that band, and the limitation of its [only] three non-overlapping channels.”).

<sup>31</sup> See Middle Class Tax Relief and Job Creation Act of 2012, Pub. L. No. 112-96, § 6406, 126 Stat. 156, 231 (2012) (*codified at* 47 U.S.C. § 1453) (“Spectrum Act”). U-NII devices are designed to provide short-range, high-speed wireless networking capability.

<sup>32</sup> See FCC 5 GHz Notice.

<sup>33</sup> See Comments of Comcast Corp., ET Docket No. 13-49 at 14-17 (May 28, 2013) (“Comcast 5 GHz Comments”).

<sup>34</sup> See Cisco, *801.11ac: The Fifth Generation of Wi-Fi Technical White Paper*, 3 (Aug. 2012), available at [http://www.cisco.com/en/US/prod/collateral/wireless/ps5678/ps11983/white\\_paper\\_c11-713103.pdf](http://www.cisco.com/en/US/prod/collateral/wireless/ps5678/ps11983/white_paper_c11-713103.pdf).

<sup>35</sup> See *id.* at 4.

support 802.11ac.<sup>36</sup> Specifically, power levels are prohibitively low in some parts of the band. Rules unnecessarily prevent any outdoor use of a large part of the band where there are no government incumbents. And government operations in another part of the band result in rules that require the use of cumbersome “listen-before-talk” technologies (also called Dynamic Frequency Selection, or “DFS”). As a result, there is only a fraction of the current 5 GHz band that providers can use for consumer Wi-Fi networks.

Fortunately, the FCC has proposed changes to its 5 GHz rules that would make the band far more attractive to investment and build-out of unlicensed services without causing harmful interference to incumbent users.<sup>37</sup> In the comments we filed with the FCC this summer, Comcast supported the FCC’s proposals to: (1) harmonize the 5 GHz U-NII-1 and U-NII-2 bands by removing an indoor-only restriction and increasing allowable power levels in the U-NII-1 band; (2) harmonize the U-NII-3 and the new U-NII-4 bands by setting the technical rules in U-NII-4 to match those of U-NII-3; and (3) update technical protections for government operations in the U-NII-2 bands but not extend DFS to either the U-NII-1 or U-NII-4 bands.<sup>38</sup>

These proposals have received widespread support from a broad range of stakeholders, including both industry and public interest groups, because they enable more effective spectrum sharing in the 5 GHz band.<sup>39</sup> Importantly, if the FCC moves ahead, devices operating in the 5 GHz band will continue to be subject to the FCC’s rules prohibiting U-NII devices from creating harmful interference to existing users. Comcast’s position has always been that the FCC should adopt rules that protect incumbent operations while allowing commercially reasonable unlicensed operations.

As Congress and the Administration have recognized, this kind of spectrum sharing, where technically feasible, maximizes the efficient use of spectrum and permits the simultaneous delivery of multiple services that provide significant public benefits.<sup>40</sup> The 5 GHz band is an ideal band to implement this approach. However, Congress and the FCC must not allow incumbents to block needed improvements to the rules. With consumer demand for wireless broadband increasing, the importance of wireless services to the economy growing, and the emergence of far more efficient technologies, we simply cannot allow incumbent intransigence to leave huge bands unused or underutilized. We will protect existing users from harmful interference. But we cannot afford to allow unnecessary delay. Congress and the FCC should

<sup>36</sup> See *WiFi Spectrum: Exhaust Looms* at 21 (noting that “the full benefit of 802.11ac cannot be realized under the current terms of access to 5 GHz [spectrum]”).

<sup>37</sup> See *FCC 5 GHz Notice ¶¶ 26-28*.

<sup>38</sup> See *Comcast 5 GHz Comments* at 21-22 (May 28, 2013) (setting forth the five principles that the FCC should adopt as it moves forward with the 5 GHz proceeding).

<sup>39</sup> See, e.g., Comments of Nat’l Cable & Telecomms. Ass’n, ET Docket No. 13-49, at 12-23 (May 28, 2013); Comments of Wireless Internet Serv. Providers Ass’n, ET Docket No. 13-49, at 6-12 (May 28, 2013); Comments of Consumer Elecs. Ass’n, ET Docket No. 13-49, at 12-14 (May 28, 2013); Comments of Cisco Systems, Inc., ET Docket No. 13-49, at 41-56 (May 28, 2013).

<sup>40</sup> See Executive Office of the President, President’s Council of Advisors on Science and Technology, Report to the President: Realizing the Full Potential of Government-Held Spectrum to Spur Economic Growth at vi (July 2012) (“The essential element of this new Federal spectrum architecture is that the norm for spectrum use should be sharing, not exclusivity.”).

not allow incumbents to refuse to adjust their systems where flexibility would allow substantially more intense use of spectrum.

With this in mind, Comcast has urged the Commission to move ahead with improvements to each individual 5 GHz sub-band as soon as it has the information it needs to devise new rules for that band. For example, in a major development, NTIA and the Department of Defense (“DOD”) recently announced in a letter to the FCC that the government had determined that it did not require access to the U-NII-1 band as part of the process of making the 1755 MHz band available for auction.<sup>41</sup> As a result, the FCC now has a complete record on the U-NII-1 band and can issue a decision to allow outdoor operations and a higher power level. These two improvements would convert U-NII-1 from a band that Comcast and other providers simply cannot use today because of FCC regulations into a powerful tool to meet consumer broadband needs.

The record is clear that the Commission can make these two changes without causing harmful interference to the one incumbent user of this band. With DOD’s announcement that it does not need to use the spectrum, the only U-NII-1 incumbent is Globalstar, a mobile satellite services provider. While Globalstar’s operations are certainly important, it does not make sense for our country to reserve 100 MHz for the private use of a single company that uses it for four feeder link locations in the entire country, serving a very small group of customers with a highly specialized satellite handset service – *especially when the record shows that the FCC’s proposed rule changes would allow Globalstar and Wi-Fi to share without any harmful interference.*

In weighing the benefits of moving forward, it is important to remember that a substantial number of existing Wi-Fi devices can already access this band. So, with just a software update and revised FCC rules, we could double the amount of 5 GHz spectrum available for commercially viable Wi-Fi deployment that consumers could access almost immediately. We should move ahead on opening the U-NII-1 band for unlicensed use without further delay.

Comcast is also enthusiastic about the FCC’s proposals for the U-NII-4 band. Regarding the U-NII-4 band, the record is clear that unlicensed services like Wi-Fi can co-exist with incumbent satellite operations without causing harmful interference. The FCC has also assigned licenses in this band for the Dedicated Short-Range Communications (“DSRC”) service. This service eventually intends to enable vehicle-to-vehicle and vehicle-to-infrastructure (“V2V” and “V2I”) wireless automotive communications applications.<sup>42</sup> Comcast and other interested parties have reached out to DSRC interests to discuss how to work together to implement sharing methodologies without delay. We are committed to finding an approach that will both protect DSRC and allow commercially reasonable Wi-Fi deployment. Although the FCC allocated this spectrum to DSRC well over a decade ago, DSRC is still not commercially available. As a consequence, this is a golden opportunity to design both Wi-Fi and DSRC use of the band to allow sharing that will produce the best overall result. Equipment vendors that serve both

<sup>41</sup> See Letter from Teresa Takai, Chief Info. Officer, DOD, to Lawrence Strickling, Asst. Sec’y for Commc’ns & Info., U.S. Dep’t of Commerce, at 1 (Jul. 17, 2013), attached to Letter from Karl Nebbia, Assoc. Adm’r, Office of Spectrum Mgmt., U.S. Dep’t of Commerce, NTIA, to Julius Knapp, Chief, Office of Eng’g and Tech., FCC (Jul. 22, 2013).

<sup>42</sup> See generally DSRC: The Future of Safer Driving Fact Sheet, Research & Innovative Tech. Admin., Dep’t of Transp., [http://www.its.dot.gov/factsheets/dsrc\\_factsheet.htm](http://www.its.dot.gov/factsheets/dsrc_factsheet.htm) (last visited Sept. 27, 2013).

industries, including Qualcomm and Cisco, have suggested promising paths toward an efficient sharing solution. But finding the right result will require flexibility on both sides. We are willing to be flexible to achieve this goal, and we hope that DSRC interests will be flexible as well.

To that end, policymakers should be asking probing questions of the DSRC community, such as: When will this technology actually be available to consumers? How much of the U-NII-4 licensed spectrum is actually necessary for V2V and V2I technologies? Are there other technologies such as radar that may be more effective, more cost effective, and/or more readily available than V2V and V2I technologies? While these yet-to-be-commercially-adopted technologies may sound appealing, the reality is that we can no longer afford to delay in putting this spectrum to use for consumers. So sharing this band with Wi-Fi is the best way to ensure intense use of the band while DSRC technologies continue to develop.

### **III. CONCLUSION**

The future of wireless is bright, and Comcast is very excited to be a part of that future. Consumer demand for wireless services – licensed and unlicensed – continues to grow at unprecedented rates, creating new opportunities to provide innovative technological solutions and drive economic growth. Unlicensed wireless services in particular have proven to be an invaluable part of the wireless ecosystem, dramatically enhancing the value of licensed wireless and fixed broadband services.

All indications are that the trends toward heavier reliance on unlicensed services will continue well into the future. Congress, the FCC, and NTIA have made important strides by addressing the substantial policy challenges raised by this rapid technological development. Continued growth in this area will require more spectrum to address the critical shortages that are already occurring in many locations around the country. It will also require a reevaluation of the regulations that govern unlicensed operations, especially in the 5 GHz band. The FCC's current 5 GHz proceeding is a welcome development, but the FCC, NTIA, and other stakeholders need to move expeditiously to ensure that spectrum finds its way to the marketplace in a timely manner.

Comcast is firmly committed to engaging with Congress, the Administration, and the FCC as they continue to evaluate our nation's spectrum policy and to implement solutions that will produce even greater economic and technological growth and benefits for consumers.

Thank you for the opportunity to testify today.

Mr. WALDEN. Mr. Nagel, thank you for your testimony. We appreciate it. And now we go to Bob Friday, who is the Vice-President and Chief Technology Officer of Cisco. Mr. Friday, thank you for joining us. We look forward to your testimony, sir.

#### STATEMENT OF BOB FRIDAY

Mr. FRIDAY. Chairman Walden—

Mr. WALDEN. And if you could just touch that little microphone button there?

Mr. FRIDAY. So Chairman Walden, Ranking Member Eshoo and members of the subcommittee, thank you for the opportunity to appear before you today. It is an honor. Mr. Chairman, we are in the midst of a technology revolution to mobilize the Internet. And it is transforming the way Americans and billions of people around the world collaborate, communicate and connect to the Internet. The education customers I work with are incorporating video, mobile applications into their curriculum with up to 100 students in auditoriums, accessing the network simultaneously. Health customers are relying on Wi-fi to educate patients—devices and provide nurses instant access to medical records, and manufacturing customers are increasingly Wi-fi to enable workers on the factory floor to have real-time video conversations with experts anywhere in the world.

What do these things all have in common? They all depend on Wi-fi for connectivity. In these areas and so many more, Wi-fi has become a central way for people to access the Internet. But a new challenge has emerged due to Wi-fi's spectacular success. There is a looming spectrum crunch in front of us, which if not addressed will slow activity, economic growth, and economic technology leadership and mobility. The Wi-fi—the widespread adoption of Wi-fi, it began in the early 2000s when most of us here got us first taste of mobile Internet at our homes, coffee shops, hotels and airports. Today, Wi-fi's reach has expanded into the workplace, air travel and many other locations. And Wi-fi will become a critical complement, a safety valve if you will, to our cellular networks in helping offload mobile Internet traffic from our licensed spectrum.

By 2017, 66 percent of all mobile Internet traffic, fully two-thirds, will either start or end on a Wi-fi network. Without offloading licensed spectrum networks, we will simply be overwhelmed. In just over a decade, Wi-fi has become a dynamic economic driver leading to over 37 billion dollars of economic value for the U.S. economy every year. And it is the foundation for a whole new mobile app economy that it has created more than 500,000 new jobs since 2007.

The development of Wi-fi is one of the great American innovation stories. Thirty years ago, unlicensed spectrum was considered junk or garbage spectrum, a place for tinkerers and/or vendors to build low-powered devices of limited use. Then the FCC came up with a simple ideal, change the rules to allow spectrum technologies to share unlicensed bands with the one caveat, no harmful interference to incumbent users. Innovators and entrepreneurs rushed in. Wi-fi was born, and the results have been breathtaking. Six billion Wi-fi enabled devices have been shipped since 2000, and this number is expected to grow to 15 billion by 2017. Wi-fi has become



the industry standard alongside cellular for connecting to the Internet now.

Wi-fi will be a driver in the development of the Internet as well. We are moving to an Internet of everything that will connect people, process, data and things that is leading to profound changes in manufacturing, agriculture, energy and dozens of other sectors. But this potential is limited by the looming spectrum crunch.

So what can be done here? The industry has a major role to play, particularly in the development and deployment of next generation of Wi-fi known as 802.11ac. This technology is more efficient and can handle vastly more traffic than previous generations. It will deliver throughputs of 1 gigabit per second or faster, hence the name gigabit Wi-fi. Here in front of me, I have the first Cisco gigabit Wi-fi access point. In June of 2013, it became the first enterprise access point to have a gigabit Wi-fi certification, 1 of over 190 devices that have been certified to date. So gigabit Wi-fi is real. It is here. It is needed to meet the exploding demand for video. But to realize that full potential of gigabit Wi-fi, wider bands of contiguous spectrum are needed. So policymakers have a major role to play as well providing more spectrum.

The Energy and Commerce Committee led the way in 2012 when you directed the FCC and NTIA to study the feasibility of sharing additional spectrum for Wi-fi in the 5 gigahertz span. And I want to thank you for your leadership on this, as well as the effort to establish voluntary incentive auctions. To be sure there are some significant technical challenges in the 5 gigahertz band, it is not clear spectrum. It contains incumbent uses important for national security and public safety. And it is imperative that Wi-fi not create harmful interference to these incumbent systems. And Cisco will not settle for less. Yet with the leadership from the FCC and the NTIA, and the cooperation of our industry partners, we are confident that technology solutions to these challenges can and will be found.

The bottom line, adding more spectrum for broadband and Wi-fi will lead to new ecosystems, new industries, new jobs, as well as help ensure economic technological leadership around the globe.

Cisco stands ready to work with this committee and other policymakers to find solutions to the important challenges before us, and I want to thank you for your time.

[The prepared statement of Mr. Friday follows:]

**The Importance of Wi-Fi to the U.S. Economy  
Testimony for Bob Friday  
November 13, 2013**

Chairman Walden, Ranking Member Eshoo and members of the Committee:

Thank you for the opportunity to appear before you today.

Mr. Chairman, we're in the midst of a technology revolution that is transforming the way Americans and billions of people around the globe connect, communicate, and collaborate.

- In schools, educators are incorporating video and apps into the curriculum, sometimes with 25 students per classroom accessing the network at the same time.
- Hospitals are using mobile devices for instant communication, patient education, and access to medical records.
- And in manufacturing, workers are using mobile devices to get instantaneous alerts of equipment failure, to control machines remotely and to have real time video conversations with coworkers.

What do these things have in common? They depend on Wi-Fi to connect. In these areas, and so many more, Wi-Fi has become a central way that people access the Internet.

But a new challenge has emerged due to Wi-Fi's spectacular success. There is a looming spectrum crunch, which if not addressed, will slow productivity, economic growth, and American technology leadership.

The widespread adoption of Wi-Fi began in the early 2000s and provided our mobile Internet experience at home, coffee shops, airports and hotels. Today's Wi-Fi reach has expanded into the workplace, air travel, and so many other locations.

By 2017, Cisco predicts that nearly two-thirds of all U.S. Internet traffic will start or end on Wi-Fi. And Wi-Fi will be the critical complement – a safety valve, if you will – for cellular networks, which themselves require more licensed spectrum. By 2017, 66% of the traffic from mobile-enabled devices will be offloaded to Wi-Fi.

Offloading means that mobile traffic is shifted from a licensed cellular network to a unlicensed Wi-Fi network -- to ease traffic, save minutes and reduce cost. Without offloading, licensed cellular networks would be overwhelmed.

In just over a decade, Wi-Fi has become a dynamic economic driver, generating \$37 billion of economic value for the U.S. every year (according to the FCC), leading to new industries, new ecosystems, and new jobs.

The development of Wi-Fi, in fact, is one of the great American innovation stories.

Thirty years ago, unlicensed spectrum was considered “junk” or “garbage spectrum,” a place for tinkerers and inventors to build low power devices of limited applicability.

Then the engineers at the FCC came up with a simple idea: Change the rules to allow ‘spread spectrum’ technologies to share unlicensed bands. The one caveat: no harmful interference to other users.

Innovators and entrepreneurs rushed in. Wi-Fi was born. And the results, breathtaking. Six billion Wi-Fi enabled devices have been shipped since 2000, and this number will grow to 15 billion by 2017. Wi-Fi has become *the* industry standard.

Wi-Fi will be a driver in the development of the next Internet as well. We’re moving to an “Internet of Everything” that will connect people, process, data and things, leading to profound changes in manufacturing, agriculture, energy, and transportation and dozens of other sectors.

But this potential is limited by the looming spectrum crunch.

So what should be done?

Industry has a major role to play, particularly in the development and deployment of next-generation Wi-Fi, known as 802.11 ac.

This technology is more efficient and can handle vastly more traffic than previous generations. It will deliver throughput speeds of 1 gigabit per second or faster – hence the name “Gigabit Wi-Fi.”

I have the first Cisco Gigabit Wi-Fi wireless access point in front of me. In June 2013 it became the first enterprise class access point to have a Gigabit Wi-Fi certification published by the Wi-Fi Alliance. It is now one of over 140 devices that have been certified.

Gigabit Wi-Fi is real, it’s here, and our customers are demanding it.

But it requires wide bands of contiguous spectrum to handle the massive increase in demand driven by video. Technological improvements aren’t enough.

So policymakers also have a major role to play and should provide more spectrum for Wi-Fi, relying on the principles of sharing and non-interference that form the foundation of unlicensed spectrum for the very beginning.

The Energy and Commerce Committee led the way in 2012 when you directed the FCC and NTIA to study the feasibility of sharing additional spectrum for Wi-Fi in the 5 GHz band, and I want to thank you for that leadership on this, as well as the effort to establish voluntary incentive auctions in the licensed area.

To be sure, there are some significant technical challenges in the 5 GHz band. It is not cleared spectrum. It contains incumbent uses important for national security and public safety. So we have to get this right.

And a successful outcome to the FCC's current examination of 5 GHz means that Wi-Fi cannot create *harmful* interference to those incumbent systems. Cisco will not settle for less.

Yet, with leadership from the FCC and NTIA and the cooperation of our industry partners, we remain confident that technological solutions to these challenges will be found.

Bottom line: Adding more spectrum for broadband and WiFi is critical for future growth of mobile networks and the American economy. It will lead to new ecosystems, new industries and new jobs, as well as help ensure American technological leadership.

We stand ready to work with this committee and other policymakers to find solutions to the important challenges before us.

Mr. WALDEN. Mr. Friday, thank you. And I think we all agree, this is a huge opportunity for the country for innovation and technology for new jobs, new devices, replacement of all our existing devices so we can communicate faster.

I have a question for the group. Qualcomm, which manufactures equipment for both intelligent transportation applications and Wi-fi, has suggested that moving ITS operations to the top of the ITS band and then excluding them from sharing with Wi-fi would solve many of the challenges in the UNII-4 band. I'd like to ask unanimous consent to enter into the record the comments of Qualcomm in the FCC's proceedings on this matter without objection.\*

Mr. WALDEN. So, Mr. Friday, let's start with you. Do you agree with Qualcomm's approach?

Mr. FRIDAY. So if we look at Qualcomm, we think the proposal has merit in terms of spectrum efficiency. We think it may be a little late in the game, given that ITS is as far down the path as they are. So yes, we think it has merit, but we think it may be a little late to the discussion.

Mr. WALDEN. Does that mean it is too late for the discussion?

Mr. FRIDAY. No, I don't think it is too late. I think it is something that is worthy to take a look at. But I think we acknowledge that the ITS has done a lot of work on the DSRP.

Mr. WALDEN. Right.

Mr. FRIDAY. And we are sensitive to that.

Mr. WALDEN. OK. Mr. Knapp, is there anything about the top of the ITS band, as opposed to the bottom, that would moot the work that has been done over the last decade on ITS?

Mr. KNAPP. Sir, I think ITS has envisioned that it would have the entire 75 merits, and has been planning for that. So we did not tee up the question of whether we should change the allocation. And generally, with unlicensed, it shares on an un-interference basis, so it would be a completely different direction than was teed up in the Commission's notice.

Mr. WALDEN. Mr. Kenney, if this arrangement did indeed prevent harmful interference to ITS, would Toyota support such an outcome?

Mr. KENNEY. Sir, first of all, we appreciate our friends from Qualcomm stepping up with this idea. We invite everyone to put ideas on the table. We think that there are a couple of fundamental problems with it, which we have documented in our FCC filings. One of them is that it has a premise that all of the safety critical communication could be compressed into one or two channels. And the fact is that is just not true. With the plans that we have for using the spectrum for collisions avoidance, for public safety, for automated driving, for security, for a number of other things, we need all of the spectrum, and we plan to have safety critical communication in all of it. So that premise that underlies their proposal just doesn't quite bear out.

The second motivation that they offered for putting this forward was that it was a way to streamline this whole process, perhaps to—it may be something we can all agree to in this space of a cou-

\*The information has been retained in committee files and is also available at <http://docs.house.gov/meetings/IF/IF16/20131113/101359/HHRG-113-IF16-20131113-SD010.PDF>.

ple of months and skip all of this. But that misses the point that we have been—for our v-to-v collision avoidance work, we have been concentrating on testing rigorously, and with our current band plan. And if we were to change and reshuffle the deck, so to speak, we would need to repeat a lot of that testing. We would incur a lot of delay. We would have to worry about cross channel interference issues, for an example that we haven't had to worry about yet.

Mr. WALDEN. Sure. So let me ask you two questions. I think you began this effort '93 or thereabouts. What is your timeline—and I realize you are innovating as you go, trying to get this right. And the second point, are there non-sort of safety security communications in the 75 megahertz of band—in other words, is it all critical safety, or are there other offerings that could be moved somewhere else?

Mr. KENNEY. Yes. So with the regard to the timeline question, as you probably know, we are at a fairly critical point waiting for the NHTSA regulatory direction. There are a number of different deployment paths we can take once we get that direction. It will become much clearer. But we are at a pre-deployment phase. Our technology is mature. The fact that our European colleagues are committed to deploy this in only 2 years from now is evidence of that.

Mr. WALDEN. Are they using the same band?

Mr. KENNEY. Yes, they are—well, they are using a subset of it. They have 30 megahertz that is the subset of our 75.

Mr. WALDEN. And are they able to do everything there that you are proposing to do here?

Mr. KENNEY. Well, they are planning to augment that with two additional allocations as time goes on. So they are starting with 30, then they are going to go to 50 and then they are going to go to 70. So it would be 70 that matches us.

Mr. WALDEN. Is the 30 mission critical? Is it safety security first?

Mr. KENNEY. Yes, that is what they are starting with.

Mr. WALDEN. And is the other, will it be safety? Or is it additional—

Mr. KENNEY. I think that it remains to be seen. What they are saying is that the middle 30—their 30 is in the middle of our 70, if you will. And that is safety critical. They are planning to put some non-safety applications in the next 20.

Mr. WALDEN. What would that be? Give me an example.

Mr. KENNEY. Examples of that might be infrastructure to vehicle communication to provide navigation assistance or traffic updates.

Mr. WALDEN. OK.

Mr. KENNEY. Or even commercial services to tell you what you can access in the road up ahead.

Mr. WALDEN. I see. All right.

Mr. KENNEY. But to come to your second question then.

Mr. WALDEN. Yes.

Mr. KENNEY. Yes, there are non-safety critical communications that will be in our band. But they won't be—they won't have a dedicated channel. They will be mixed in at a lower priority below, if you will, the safety critical communication that we planned to put in these channels.

Mr. WALDEN. I see. Yes. All right. Thank you, Mr. Kenney. My time has expired. I will turn to my friend from California, Ms. Eshoo, for 5 minutes.

Ms. ESHOO. Thank you, Mr. Chairman. And thank you to each one of you, important and very interesting testimony.

I want to start out, Mr. Nagel, by thanking you and Comcast for what you did during the tragedy in Boston by—for the use of your network. And you know, it is stories like that that always remind me in the hearing room or whatever I am doing here that we have a wonderful sense of unity about us, even though we have got lots of problems, challenges, some we create, others are there and we have to address them. But it is wonderful to hear you talk about that. And so I salute you. I think the entire committee does. Thank you.

Mr. Knapp, I leaned over and I said to my colleagues, Henry said that Mr. Knapp is terrific at breaking down everything so we can understand it, and I am having a hard time understanding you. So I want to dig into your testimony and see where we are making some progress here. The DoD recently indicated that it doesn't intend to add additional systems to the 5150 and the 5250 megahertz band, also known as UNII-1 band. Do you think that the FCC can proceed to make the band available for higher power outdoor Wi-fi services on an expedited basis?

Mr. KNAPP. So——

Ms. ESHOO. Because that would be an important step, I think.

Mr. KNAPP. Yes, we are certainly considering that. The issue——

Ms. ESHOO. Seriously? Are you considering it seriously?

Mr. KNAPP. Whether we can address that lower piece first, it was not a subject to the additional studies.

Ms. ESHOO. Yes.

Mr. KNAPP. But just to be clear, there were oppositions that were filed by the satellite industry.

Ms. ESHOO. Yes.

Mr. KNAPP. And we are busy analyzing that work.

Ms. ESHOO. I see. OK. Well, that is hopeful. To Mr. Friday at Cisco, thank you again. You brought a very important and hopeful message to us in terms of what all of this represents. It is my understanding that Cisco is advocating a listen, detect, avoid approach to successfully manage interference at the 5.9 gigahertz. Does this mean that Wi-fi and DSRC could coexist peacefully? Put your microphone on. I am dying to hear your answer.

Mr. FRIDAY. Yes. No. Thank you.

Ms. ESHOO. Yes.

Mr. FRIDAY. No. Thank you for the question. And, yes, Cisco has proposed a solution to co-share the band with DSRC.

Ms. ESHOO. Yes.

Mr. FRIDAY. We have looked at DSRC. The roots of DSRC comes from .11.

Ms. ESHOO. Yes.

Mr. FRIDAY. So compared to radar, it has the same DNA as .11. We think there is a relatively easy way to share the band and be able to detect DSRC signals and basically vacate the band within the blink of an eye once we detect those signals.

Ms. ESHOO. Excellent. So to Mr. Kenney, what Mr. Friday just described sounds exciting to me and reasonable. Do you agree?

Mr. KENNEY. Yes.

Ms. ESHOO. Good.

Mr. KENNEY. So as to echo my earlier statement, we are very happy that Cisco has stepped up with this idea, and we think that it has real potential. The fact that there is this common DNA, if you will, between the DSRC underlying technology and Wi-fi is a positive that makes it so that they should be able to detect us and vacate the channel when they detect us.

Ms. ESHOO. Yes. Yes. And to Mr. Friday and Mr. Nagel, can you describe the difference in consumer experience between existing Wi-fi and gigabit Wi-fi?

Mr. NAGEL. Sure. You know, today what we have is we have a Wi-fi environment. We have all spoken about how we all use it. It is highly digestible. It is in everywhere we are. And I think one of the things we are experiencing today is that we use it a lot. And so one of the components of that experience is that in certain places we get congestion, and the things we want to do aren't we can't do the as much as we used to. What gigabit Wi-fi does is that it really begins to expand our ability to drive very, very high rates of information to not just one device but multiple devices, maybe even hundreds of devices. And so the platform that is getting built for an individual user will feel faster. It will feel better. It will feel like I am more connected. Just like I always had an Ethernet, you know, cord right into the back of my device that none of our devices have, it will feel very similar to that.

Equally importantly though, as you think about gigabit Wi-fi, there is a consumer experience side. But once you build it, then you have this platform that you mentioned, rightly, which is it is an innovation platform. Once you build it, you're going to have lots of companies that come out and begin to go deeper and build great things we don't even know about today.

Ms. ESHOO. Yes. Wonderful. Do I still have some time?

Mr. FRIDAY. And to add on what Tom was saying is—

Ms. ESHOO. Yes.

Mr. FRIDAY. The customers that we are working with right now, like in the universities and higher ed, the use cases that we are seeing are in these auditorium and classroom cases where they are actually getting into a congestion problem where students cannot get access to the curriculum on time.

Ms. ESHOO. Yes. Yes.

Mr. FRIDAY. So that is where Wi gig brings the capacity we need to be able to solve these types of use cases. The other consumer use case we are seeing right now is in our healthcare industry.

Ms. ESHOO. Yes.

Mr. FRIDAY. The healthcare industry has been probably at the leading edge of adopting a Wi-fi. When you go into these hospitals now, besides the nurses, we have connected probably more devices in the healthcare space—and this is becoming a critical issue now of how to make sure that all these healthcare—

Ms. ESHOO. No, I have seen it at Lucile Packard Children's Hospital in the operating room.

Mr. FRIDAY. Yes. And it has become—



Ms. ESHOO. Yes.

Mr. FRIDAY. The healthcare industry is a good example where they have become highly reliant on Wi-fi to connect the sensors to all the people.

Ms. ESHOO. Thank you very much. Mr. Chairman, I am sure I have gone past my time. Thank you.

Mr. WALDEN. You are welcome. I will turn now to the vice chair of the full committee, Ms. Blackburn, for 5 minutes.

Mrs. BLACKBURN. Thank you, Mr. Chairman. I want to thank all of you for being here. And, Mr. Friday, I want to thank you for mentioning the healthcare. We see so much of this in Nashville, and there is a tremendous amount of cross-usage and innovation. And one of the things we hear regularly from people is, what are we going to do about the spectrum crisis that is coming and as they do connect more healthcare devices. We are seeing firsthand how important that is going to be.

I want to ask you a question. Going into your testimony, you said that a successful outcome to the FCC's current examination of 5 gigahertz means that Wi-fi cannot create harmful interference to those incumbent systems. So let us touch on that for just a minute. And see here, tell me what you think needs to happen to find a solution that protects against harmful interference to the incumbents, and also accommodates some of these new unlicensed devices and technologies that can continue to help grow the economy but also expand the usage, the healthcare—we have a lot of entertainment product in Nashville that is trying to share the space. I see your heads all nodding. Last week was CMA week in Nashville. And, of course, with all the performances and tours, this is something that we discussed a good bit. So if you will just speak to that for a couple of minutes? I think I have got constituents that would be interested to hear your answer.

Mr. FRIDAY. Yes, so when you look where unlicensed started with, the whole premise was sharing without harmful interference to the incumbents. The journey started back in the '80s with spread spectrum, and that was kind of the initial technology that we brought to share the spectrum. DFS was the next technology we brought to share with the radar bands, and USIS. The work we are working with the ITS community right now is really another detection technology. In this case, we think it is a relatively simple technology since we have the same DNA. When we look forward in how we can share the other bands, we are looking to new technologies like databases. And we believe that as we move into this mobile Internet world, given spectrum as a fixed resource, we are going to have to start developing more sharing technologies to keep up with the mobile demand that we see happening in that space.

Mrs. BLACKBURN. OK. Mr. Nagel, did you want to comment on that?

Mr. NAGEL. I think the Wi-fi area in general is a great way to take fantastic broadband speeds we are all used to that are sitting at our desk in our home, in our office and make it available outside of that, that footprint. It is mobile broadband, and it is probably the best implementation of it to where you can do really, really, really fast speeds. Gigabit Wi-fi is one of those things that allows us to do that. And it is one of the reasons why we are here is be-

cause we won't be able to do those things if we don't solve some of these spectrum issues, especially in the unlicensed band in the 5 gigahertz, both at the lower end but also at the upper end.

I think when you think about—if you look at what is happening in the UNII-1, that especially with the DoD saying they don't need access to it, it is a great place for us to begin to bring rural spectrum and be able to bring it to bear quickly. So if we decided to do that, the FCC ruled that way. Your devices you have in your hand today, the access points that we are deploying can utilize that spectrum very, very quickly. So we would be able to alleviate rural spectrum crunches in those locations in places that are education, healthcare, those types of things. Where people are gathered, Wi-fi is a fantastic solution. And it is why we need those spectrum to do more of that, but also broader channels so we can do more of it at the same time in the same location. So it is solving both problems, more unlicensed spectrum and then also aggregating the channels so we can get the gigabit Wi-fi working at the same time.

Mrs. BLACKBURN. OK. Mr. Knapp, let me ask you this. We talked a little bit—Mr. Nagel mentioned in his testimony UNII-1. And I want to ask you if you think with one company operating in that 100 megahertz if the FCC has the information to act now on sharing in that space?

Mr. KNAPP. So the issue in that space is simpler than the sharing we are talking about in the other bands. We have a full record. I expect there will be ongoing dialog on the one issue that is outstanding, and that is the sharing with the satellite service. Bear in mind that the services that are allocated spectrum, and in this case satellite, are protected against interference from unlicensed. So whatever we do here needs to assure that there won't be interference to the satellite service.

Mrs. BLACKBURN. Right. I appreciate that. I just think that as we—regardless of which space it is, I think it is incumbent upon us to make certain that we are using it wisely. Yield back.

Mr. WALDEN. Gentlelady yields back. At this time, the chair recognizes the gentleman from Michigan. Thank you.

Mr. DINGELL. Mr. Chairman, I thank you for your courtesy. I commend you for the hearing. I have a number of questions which will require simple yes or no answers.

From the onstart, I do recognize economic and technological benefits associated with wireless growth. However, with regard to unlicensed use in the 5850–5925 megahertz band, I believe that we can all agree that protecting vehicle occupant safety is a goal of paramount importance. To that end, I reference the Federal Communications Commission Acting Chairman Clyburn's November—rather September 26 letter to me stating users of part 15 devices must not cause harmful interference to the licensed services in the 5 Ghz band.

To Mr. Knapp, is it correct that the National Telecommunications and Information Administration, NTIA, released a report on unlicensed use of the 5350–5470 megahertz and the 5850–5925 megahertz bands in January 2013, yes or no?

Mr. KNAPP. Yes.

Mr. DINGELL. Now, Mr. Knapp, I believe it is also correct that NTIA's report identified a number of interference risks in the 5925

megahertz band associated with unlicensed use, and concluded that further study and analysis is necessary in order to mitigate such risks, is that correct?

Mr. KNAPP. That is correct. Yes.

Mr. DINGELL. Now, Mr. Knapp, is it true that the Federal Communications Commission's February 20, 2013, Notice of Proposed Rulemaking seeks comments on harmful interference protection requirements to permit gigabit Wi-fi devices to operate in the 5 gigahertz bands, yes or no?

Mr. KNAPP. Yes.

Mr. DINGELL. Now, Mr. Knapp, is it true that Associate Administrator Karl B. Nebbia of the Office Inspector Management at NTIA sent you a letter dated June 10, 2013, in response to the Commission's Notice of Proposed Rulemaking in which Nebbia raised concerns about potential harmful interference between unlicensed devices and DSRC systems, yes or no?

Mr. KNAPP. Yes.

Mr. DINGELL. Now, Mr. Knapp, is the Commission actively engaged in—with the wireless industry, automakers, the Department of Transportation and other incumbent users to resolve any possible harmful interference issues associated with the unlicensed use in the 5850–5925 megahertz band, yes or no?

Mr. KNAPP. Yes. Yes.

Mr. DINGELL. And will the Commission continue to be interested in that matter in the future?

Mr. KNAPP. Yes.

Mr. DINGELL. And they have got to simply because you have potential for very destructive interference, is that right?

Mr. KNAPP. Yes.

Mr. DINGELL. Now, Mr. Knapp, given that the Commission licensed the intelligent transportation system service almost 15 years ago, is it reasonable to say that it would be premature for the Commission to authorize unlicensed use of the 5850–5925 megahertz band before studies are completed that confirmed that such use would not cause harmful interference with ITS services and other incumbent users, yes or no?

Mr. KNAPP. Yes, we would need a complete record.

Mr. DINGELL. Now, Mr. Knapp, in your experience, is it conceivable that the Commission would approve unlicensed use of the 5850–5925 megahertz band, which is the one used by autos, before definitively establishing no risk of harmful interference with ITS systems or establishing practical strategies to mitigate such risk, yes or no?

Mr. KNAPP. No, we would not act until the engineering work is complete.

Mr. DINGELL. Thank you. Now, Mr. Knapp, alternatively, is the Commission considering moving forward with rulemaking openings up only the 5350–5470 megahertz band to unlicensed use, yes or no?

Mr. KNAPP. Only the 5—could you repeat the question? I am sorry.

Mr. DINGELL. Go ahead and say it the way you think it is best should be said.

Mr. KNAPP. I don't expect we would move on these bands that are being studied. The one that we are considering where we have a complete record is the lower piece, the existing band.

Mr. DINGELL. I certainly thank you. Mr. Chairman, I ask unanimous consent that I have two additional minutes. I have got a lot of questions. I think they are useful to the committee.

Mr. WALDEN. Without objection, we would be delighted to have you continue this line of inquiry.

Mr. DINGELL. You are most gracious, and I thank my colleagues. Now, Mr. Friday and Mr. Nagel, are Cisco and Comcast in agreement with the unlicensed—rather than for unlicensed use of the 5925 megahertz band to be permitted, the risk of harmful interference with ITS systems must be mitigated?

Mr. FRIDAY. Yes.

Mr. DINGELL. Yes or no?

Mr. FRIDAY. Yes.

Mr. NAGEL. Yes.

Mr. DINGELL. Thank you, gentlemen. To again, Mr. Friday and Mr. Nagel, are Cisco and Comcast in agreement with both Wi-fi and ITS systems that they can share the upper 5 gigahertz band without causing harmful interference to one another, yes or no?

Mr. FRIDAY. Yes.

Mr. NAGEL. Yes.

Mr. DINGELL. Thank you, gentlemen. Now, will you please submit for the record any harmful interference mitigation proposals that your companies have developed? And would our other panel members please also submit that? Now, again, Mr. Friday and Mr. Nagel, will Cisco and Comcast actively engage with automakers to identify harmful interference mitigation solutions in the 5925 megahertz band, yes or no?

Mr. FRIDAY. Yes.

Mr. NAGEL. Yes.

Mr. DINGELL. Thank you, gentlemen. Now, a word here from Mr. Kenney. Mr. Kenney, does Toyota appreciate the potential economic and technological benefits freeing up more spectrum for unlicensed use, yes or no?

Mr. KENNEY. Yes.

Mr. DINGELL. Now, Mr. Kenney, will Toyota actively engage with the tech community to identify harmful interference, mitigation, solutions in the 5925 megahertz band, yes or no?

Mr. KENNEY. Yes.

Mr. DINGELL. Mr. Kenney, all the same, does Toyota agree with—that the Federal Communications Commission should proceed only on the basis of a solid record concerning harmful interference mitigation before approving unlicensed use of the band 5925, yes or no?

Mr. KENNEY. Yes.

Mr. DINGELL. Mr. Chairman, you have been abundantly gracious. And to my colleagues, I express my thanks.

Mr. TERRY. Mr. Chairman?

Mr. WALDEN. Yes?

Mr. TERRY. Can I state for the record that the reason why I did not object was Michigan's kindness in allowing the Huskers to score that last touchdown in the last 2 minutes for a victory?

Mr. WALDEN. The gentleman from Nebraska, I was hoping to go the entire hearing without discussing football. We didn't do so well as Ducks on Thursday night. So we will have that discussion later. Now, we will turn to the gentleman from Ohio, I think is up next, Mr. Latta, for 5 minutes.

Mr. LATTI. Well, thanks, Mr. Chairman. And again, thanks for our panel. One of the things we have talked about in this subcommittee is that industry usually is much further ahead than Congress or the regulators would be, really might be two, three, four steps behind. And that is why it is so important to have you before us today to hear your testimony. And if you just go down the line, we have been having questions as to what we are looking at today. But I would really like to ask everyone, and also from Mr. Knapp with the Commission as to where do you—we are talking about where we are today, where we are going to be in 5 years or 10 years. Just if you were looking at a crystal ball, just briefly tell me where you think—because I know that, Mr. Friday, in your testimony, you stated that between the Wi-fi side over the last decade generated about 37 billion dollars. But where are we going to be in the next 5 years, because this is changing so quickly. Where do you think we are going to be?

Mr. KNAPP. So, I think if you look at what is happening right now, as I mentioned, we are kind of moving from what I call a mobile voice paradigm, right? We are moving from this paradigm to a very mobile video paradigm on this here. So 5 years from now, I suspect we are going to see many more sharing technologies.

Ms. ESHOO. Yes.

Mr. KNAPP. When you look at the problem of this and this, this requires 100 times more capacity, which is going to require 100 times more from the fixed resource we have. So I think we are going to have to see more licensed spectrum policy, and I think we are going to have to really leverage the sharing spectrum policy going forward.

Mr. LATTI. Mr. Nagel?

Mr. NAGEL. Well, I think there are other things we will find as well. And that is that it is not just individual devices that we are going to want to have more capacity for, because they require it. It is going to be that all of us have lots of devices as well. And this will occur both inside the home with the Internet of things as we have almost everything in our home beginning to connect, and we are controlling our house. And it is one of the reasons why as we look to the future, we are sitting here today, right? I mean, as we see the growth—just looking at our network and the network that we built in Wi-fi, we have triple digit growth in sessions and users and tonnage literally every year. And it is not a baby. It is accelerating. And without some of the things we are talking about here today, I think it really becomes critical. And I think it really requires both sort of true, deep consideration, both in the UNII-1 band, which we have been talking about, but also in the UNII-4 band. I think one of the struggles that we have is when we look at sort of what has been going on in the ITS is that this is something that was thought of 15 years ago, and the world has changed so radically. You are asking what is going to happen in the next 5 years. If you looked 15 years ago what has happened that having

75 megahertz sort of dedicated seems something that was really developed, thought of and conceptualized 15 years ago, if we don't sort of fix this today and really work through how Wi-fi is going to be a part of that band, it is only going to get more expensive down the road, because there is not a lot of other spectrum to do gigabit Wi-fi in.

Mr. LATTA. Thank you. Mr. Kenney, you were talking about what could be going on with cars talking back and forth between each other. But when is it going to be that for instance, have that car drive us home or drive us to work?

Mr. KENNEY. Well, we hope to all live to experience that, don't we? That would be great. Yes, I think in 5 or 10 years, we are going to see a very different driving experience than we have today. And with respect to this period of time we have been doing research on DSRC, we are now on the threshold of being able to cash in on that research. And I think in 5 and 10 years, our drivers are going to be able to experience the benefits of having a car that can intelligently help them avoid the most dangerous driving situations. So I think that the connected car is going to be a very exciting place to be in 5 and 10 years.

Mr. LATTA. And, Mr. Knapp, hearing all of that, and with the FCC, how do you work at the FCC to make sure all these things can happen that we work with the industry out here to make sure that the regulations that are promulgated make these things come to pass?

Mr. KNAPP. Absolutely. And I wished I knew what was going to happen in 5 years. What I can tell you is this. We try to ensure that the opportunities are there with at least regulation as absolutely needed so that the innovators can flourish. Personally, I think the sky is the limit. And there are things that have happened already that nobody would have predicted. There is synergy between licensed and unlicensed in ways where 5 or 6 years ago we were arguing about which is better, when in fact the two of them complement each other.

From the standpoint of the things we are discussing today, we are going to have to continue to drive spectrum efficiency and these kinds of advanced sharing techniques that we are working on. They are hard. They take a lot of thought and a lot of work and testing to make happen. And we are going to have to keep driving down that path. Sharing isn't the only solution. I think we will still be looking at bands where reallocation makes sense. But these are going to be tough issues.

Mr. LATTA. Thank you very much. Mr. Chairman, I see my time has expired and I yield back.

Mr. WALDEN. The gentleman yields back. We now turn to Mr. Butterfield for 5 minutes.

Mr. BUTTERFIELD. Thank you very much, Mr. Chairman, to the ranking member for convening this very important hearing today. As most of you certainly know, I served on this subcommittee some years ago and went off the committee to be the ranking on another committee. And with the election of Senator Markey now, I find myself back on this committee and glad that I am here. There has been so much—there might be a round of applause, not for me, but for Mr. Markey, I suppose. But just listening to the testimony and

just reviewing the material for today, we have made great advances over the last 4 or 5 years that no one could even imagine. And, Mr. Knapp, I think you just hit the nail right on the head a few minutes ago. It is just limitless of what innovation can mean, not only for the bottom line of your companies but for the prosperity of our country. And so I want to thank you for all that you do, and thank you for your investment in the future.

I am going to start with Mr. Nagel. Mr. Nagel, I heard Mr. Friday a moment ago say that devices that support gigabit Wi-fi already exist. I am not sure I fully understand and appreciate that. Is that correct?

Mr. NAGEL. Well, it is correct in the sense that devices have within them the brains and their antennas and all that to make gigabit Wi-fi work. What it doesn't have is access to the spectrum. So you can build the electronics to make it work and be future proof, which is what they have begun to do. And a lot of the equipment we are deploying is also capable of doing similar types of things.

What is necessary though is for us to make and move forward on some of the 5 gigahertz decisions that are in front of us today. So the first would be UNII-1. We have already mentioned that all the information is in on the record, and the FCC is in the process of making some of its decision. Our view is that we can do a lot within UNII-1 and begin to bring big channels, which is really what you need. So most—like most devices today, Wi-fi use 20 megahertz channels. When you get to enough, you will put 160 megahertz together. And it is that concatenated spectrum band that allows you to do that amount of speed at one time. But it requires that spectrum and the unlicensed spectrum. And so that is where the 5 gigahertz becomes very, very important, not just in UNII-1, which is by far the easiest decision to make, we think, but also in UNII-4. And it does require harder decisions, but ones we ought to make now before we get too far down the road.

Mr. BUTTERFIELD. But typically, certification and approval usually take a long time after spectrum, would that be correct? After the spectrum is made available, typically it takes awhile to get it perfected?

Mr. NAGEL. Honestly, it is an area that I am not familiar with. I think generally that it gets—actually, I am not sure how to answer that, to be honest with you. I think that as devices get built, as long as they are within the Wi-fi standard, I think you can work within that band. Generally, when you get new bands is when you have to go through another approval, but it is not my area of expertise. So—

Mr. BUTTERFIELD. All right. In your testimony, you describe, Mr. Nagel, the growing importance of Wi-fi in times of crisis. Can you elaborate on some of the examples of when this technology has proven valuable in times of crisis, and explain the role that Wi-fi can play in going forward in emergencies?

Mr. NAGEL. Sure. I would love to. We have some examples that Comcast has been involved with. The first is Hurricane Sandy. We experienced it up in the Northeast. And when the hurricane came through, a lot of the licensed cellular networks were down. So what would end up happening is that we had some of our Wi-fi access

points that were up and running, and people would actually go to those access points. They would connect with any of their devices. They didn't have to be cellular specific. And they could actually reach the Internet. They might have to walk a few hundred yards, because that is the closest one that they had, or maybe even further. But just having that connectivity was essential to those people who were essentially without knowledge of what was going on and when people were coming to help them.

Mr. BUTTERFIELD. All right. Thank you. Mr. Chairman, since I don't have 50 years on this committee, I won't ask unanimous consent to extend my time. And so this will be my last question. Mr. Kenney, what is your response—but I want you to promise me that when I do get the years on this subcommittee, I will have that deference.

Mr. WALDEN. Let me suggest, Mr. Butterfield—

Mr. BUTTERFIELD. Yes?

Mr. WALDEN. I won't be here, unless there are incredible medical advances.

Ms. ESHOO. I am going to leave a note in the drawer—

Mr. WALDEN. Yes. And you can go ahead and ask today, but you probably wouldn't get anything.

Mr. BUTTERFIELD. Thank you. Very quickly, Mr. Kenney, what is your response to the proposal by Cisco that would require Wi-fi devices to detect and avoid the presence of DSRC systems on the channels that they wish to use?

Mr. KENNEY. We think that the Cisco detection proposal is a sound foundation to build on. We think there are a lot of unanswered questions about some of the technical details. But we look forward to exploring that as part of our outreach with the Wi-fi community.

Mr. BUTTERFIELD. With the note in the drawer, I will yield back. Thank you.

Mr. WALDEN. The gentleman yields back. We welcome you to the committee. We turn now to the gentleman from Illinois, Mr. Shimkus.

Mr. SHIMKUS. Thank you, Mr. Chairman. It is a good hearing. I am really kind of learning a lot. It is a great committee. It is just highly technologically focused for a lot of us. So this is what I am getting out of the hearing so far, the gigabit Wi-fi is the best, right? That the 5 gigahertz is the best band for unlicensed use of Wi-fi, is that—Mr. Kenney and Mr. Friday, you seem to think that the sharing aspect might work.

And Mr. Friday thinks it is almost too late to propose movement for this 10 year use of the automobile industry on this ITS system at the upper band. You have the impression that it is probably too late to go down that route, am I correct?

Mr. FRIDAY. I would say I don't know. I would say that the ITS has been working on it for a long time. But no, I don't know if it is too late or not. I just think it has been a long—they have been down that path for quite a while.

Mr. SHIMKUS. And, Mr. Kenney, I am sure you agree that you like your spot and you want to keep it?

Mr. KENNEY. Yes. That is right. We think that the allocation decisions that the FCC has made in the past make a lot of sense.



Mr. SHIMKUS. Mr. Nagel, do you want to chime in on this? Because that seems what today is——

Mr. NAGEL. I do.

Mr. SHIMKUS. You know——

Mr. NAGEL. I do want to chime in on it. I think it is an important point. So, you know, we all see what is happening in the broadband space is that we are struggling to keep up with the spectrum demands of just people connecting, and the economic value and innovation that that is bringing to the country. That the spectrum allocation has been made in the UNII-4 band was made long before any of this rapid growth happened.

Mr. SHIMKUS. It was when it was termed kind of a junk space is what was mentioned earlier.

Mr. NAGEL. It was a junk space. No one quite knew what to do with it. And so I think it is really important for us not to think about is it too late, but what is the right thing for us to do for both aspects of the American economy. One is clearly we agree with the concept of vehicle to vehicle safety. I think we would never want to do anything that would harm that. We also know that the 75 megahertz is not going to be used wholly for vehicle to vehicle safety. There are components of it that are going to have other business aspects.

The second thing we know through the recently released GAO report is that it is decades before the capability of vehicle to vehicle, sort of the full benefits, are going to be realized, primarily because the life of the fleet requires it to have this built in, you have to go in and have all the cars off the road. There will be some benefits early on, but it will be awhile. The other thing the GAO report states is that there is significant components of this whole infrastructure that are—they are sort of unknown. They are still in development. The back office component, all the pieces. So when I look at it, I see 75 megahertz of spectrum that we know Wi-fi can share with them. We would want to protect the vehicle to vehicle. But that the idea of having 75 underutilized spectrum probably doesn't make great policy says long term. And yet there is—I think what we would like to see is not a decision about whether Cisco makes sense or not, that is one of the proposals, but there are at least two proposals, maybe more. But we would like to see really rolling our sleeves up, engineer to engineer, with real compromise, trying to solve the problem of not how do I just protect all the 75 megahertz of band, but how do I make Wi-fi work within it and make it a viable business. And I think—but also protect the safety issue within the band.

Mr. SHIMKUS. And isn't in the—actually, I am visual too. So I have been watching this the whole time we have been having the hearing. So in the UNII-4, in the upper area, if there was movement there, and they are not using all the 75, you do have a big band there for the applications—the Wi-fi applications—but isn't there also a better debate where then you don't have the interference issue? Couldn't you engineer it so—we went through a lot——

Mr. NAGEL. Yes, I think we went through the live square debate. It is——

Mr. SHIMKUS. Yes. Unfortunately, I don't want to go through that again.

Mr. NAGEL. It is important to realize that what we are not saying—Wi-fi is not intended to replace the incumbent. So the idea has never been within any of these bands to say that incumbent shouldn't use that space, let us move them. Wi-fi by its nature is a sharing technology. It is meant to work within the context of the fact that you have incumbents. And its purpose is to not cause harmful interference. And where it does, we have to work through some of the technical details. It is the technical details that are required for us to sit down, both between the Wi-fi and the ITS groups, and sit down and design what is the right thing from the beginning, from sitting here where we are before it gets so far down the road that we have really underutilized spectrum which probably doesn't make sense long term.

Mr. SHIMKUS. Mr. Chairman, my time has expired. Thank you very much.

Mr. WALDEN. Thank you, gentleman. I will now turn to the gentleman from Nebraska, Mr. Terry, for 5 minutes.

Mr. TERRY. Thank you. I appreciate this. Yes, that is a very pretty chart. All the questions probably have already been asked, but not everyone has asked them. So I am going to continue. But, Mr. Kenney, why don't we go through on—it does seem that they are saying, Mr. Nagel, Mr. Friday and Knapp that there is room for both. I think reading between the lines, they didn't say it, but maybe Mr. Nagel and Mr. Friday would say they would love to have 100 percent of that band. But the reality is it has been set aside for the auto industry. I really like the idea of the vehicle to vehicle communications. I do think that is going to save lives. I like that we are getting into the 21st century in the automobile industry. That is exciting.

So you have concerns that if it is shared and there is possibility of interference that that then creates safety issues. And your vehicle to vehicle is not—communications is not reliable, then it can actually make it more dangerous on the road, not just safer. But with your thinking, it is going to communicate and tell you to stop, and it is not communicating, you are more likely to get into a wreck then. So from the automobile perspective, is there room to share? Is there danger posed in sharing?

Mr. KENNEY. Yes and yes. So with regard to is there room to share, I think the—one way to think about that question is how would sharing work. And without being too technical, I would like to suggest that it be on a spatial basis. And that means that in the roadways where the vehicles are, that is not where the Wi-fi should be using 5.9 gigahertz. If there—there are places where Wi-fi can use 5.9 gigahertz, in the living room for entertainment purposes, or in a rural area where there aren't cars driving by. And we think that that can probably be quite fine. But we don't want to have a mom driving a car down the road with kids in the backseat, and because she happens to be driving by a coffee shop that is using Wi-fi, her collision avoidance systems turns off and she isn't able to avoid a collision that she otherwise could have, or because her kids are playing some games in the backseat, whether their devices

are talking to each other using Wi-fi technology. That shouldn't be using 5.9 gigahertz Wi-fi. That should use one of the other bands.

So there is room to share, more on a special basis. There are places where it can work. There are places where it shouldn't work.

Mr. TERRY. Well, is there concerns—again, getting to what the chairman brought up at the beginning. If you are just using the top of the band, and you are allowing the rest of the band barely below that, is there going to be concerns about interference?

Mr. KENNEY. Well, yes. Let me state very clearly that we are not only going to be using the top of the band, and we are not only going to be using—we are not only going to be able to put our safety critical communication in the top of the band. We have 75 megahertz, and we expect in the deployments—

Mr. TERRY. To use all of that?

Mr. KENNEY. To be using all of it, and all of those channels will be carrying critical information. Not all the information will be critical, but all the channels will have critical information. So it is not possible to compress it into 1 or 2 channels.

Mr. TERRY. OK. Well, anybody—Mr. Nagel, Mr. Friday would like to comment further or—

Mr. FRIDAY. No, I mean, we have been working very closely with the ITS on the sharing. I mean, I think maybe Tom's point was if we had started from scratch, and we had built sharing into the original ITS design, would we have done something slightly different? And I think working with the ITS though, they have been very cooperative on trying to find, given where we are, the right solution for sharing in the band.

Mr. TERRY. OK. Now, there was some comment made, not here but before the meeting, that it is taking 10 years to get here, and maybe the auto industry should have been built out by now. I guess the conclusion to that, if you take it, is therefore you should have to give it up. What do you think about that thought, Mr. Kenney?

Mr. KENNEY. Yes, I think that the automotive industry isn't consumer electronics. And when we are talking about safety of life, one thing I have found since I have been working for Toyota is that we take it very seriously and we are very careful about deploying these technologies. So we now have the benefit of that period of time of intensive research. We have reached the threshold. We are ready to start deploying.

Mr. TERRY. All right. Thank you. My time is up.

Mr. WALDEN. The gentleman's time has expired. We go now to the gentleman from Missouri, Mr. Long, for 5 minutes.

Mr. LONG. Thank you, Mr. Chairman. Mr. Kenney, when you see these ads on TV with cars that, you know, they have you stop so you don't get into an accident, or maybe 2 cars ahead of you it tells you about an accident up there, now that is not the 5 gigahertz, is it that those rely on?

Mr. KENNEY. You are correct. Most of those types of technologies that you see advertised today are based on sensor systems that the car has, maybe it is a radar or a camera system that can detect these dangerous situations.

Mr. LONG. So wouldn't that portend that you could share these or not need those?

Mr. KENNEY. Well, we think that those technologies are critical as well. We view the vehicle to vehicle communication as complementary to that. There are limitations of those sensor based systems. Their ranges are limited. Communication can go further. If there is a vehicle in between you and the danger, the sensor may not be able to see it, whereas communication can let you know about it. If there is a vehicle coming—

Mr. LONG. So it could be used in that instance on the 5—

Mr. KENNEY. I am sorry?

Mr. LONG. The 5 gigahertz could be used in that instance?

Mr. KENNEY. Yes. Yes.

Mr. LONG. To prevent an accident?

Mr. KENNEY. So we think that the 5.9 gigahertz communication and the sensor based systems on vehicles will work together to give us a very safe driving experience.

Mr. LONG. But that is futuristic? That is not happening now? They are not using that now?

Mr. KENNEY. The communication part is not yet deployed, but that is coming very soon.

Mr. LONG. OK. And, Mr. Knapp, I have got a question regarding the dedicated short range communications. My constituents' privacy is real important to them. So for people back in my district, do you think the FCC will propose protections of an individual's privacy so car companies won't be sending personalized advertisements to individuals based on where their car is located?

Mr. KNAPP. So the Commission has provided the spectrum. The standards are developed by the industry, including privacy protections. And I think the GAO report had addressed the importance—the need for the standards to address this. And I know that the industry has been taking those things into account. The FCC generally has not set standards specifically for that.

Mr. LONG. That doesn't work unless they mandate that all cars have this, is that correct, or—

Mr. KNAPP. So the technology contemplates communication between vehicles. And so some of speculated that a percentage of the vehicles would provide an added benefit. But the idea is that eventually all of the vehicles would have this technology. As compared to what we just heard described, the radars that are built in, the car basically works autonomously. I don't need to communicate or worry about whether something is installed in somebody else's car.

Mr. LONG. OK. Mr. Chairman, I yield back.

Mr. WALDEN. The gentleman yields back the balance of his time. And I think that takes care of all our members and their questions. I do have a unanimous consent request, a report from SES and Intelsat, detailing interference concerns of satellite providers in the 5.9 gigahertz band, and a GAO report by Mr. Nagel that he referenced on the benefits and challenges of ITS. So we would like to put it in the record without objection. So ordered.\*

Ms. ESHOO. Mr. Chairman?

Mr. WALDEN. Gentlelady from—

\*The information has been retained in committee files and is also available at <http://docs.house.gov/meetings/IF/IF16/20131113/101359/HHRG-113-IF16-20131113-SD009.PDF> and <http://docs.house.gov/meetings/IF/IF16/20131113/101359/HHRG-113-IF16-20131113-SD008.pdf>.

Ms. ESHOO. I would just close out the hearing today by saying thank you to Roger Sherman for his superb service here. I really don't know what we are going to do without Roger. That is how fabulous he really is. He is, I think in many ways, in a class by himself, and I think that it is an eloquent statement about him that the new chairman of the Federal Communications Commission has chosen him, named him as the acting chief of the FCC's Wireless Telecommunications Bureau. I don't know how many members know his background. In the 111th Congress, Roger—he began here. And he has really been the backbone of this subcommittee. And he has led the staff in a way that really brought out the best leadership qualities of everyone that was part of the team. And I think that that is the mark of a leader, and a confident leader. He has supported members and staff on every issue we have tackled. He really has been the indispensable person here. His strategic guidance, his expertise, his professionalism are all going to be missed, I think, by every member of the committee, and to our colleagues here on the subcommittee on the other side of the aisle. I think when we go to negotiate, you are going to miss Roger as well.

You may even be relieved that he is not there. But he is not going to be far away. He is not going to be far away.

Mr. WALDEN. That is right. We are going to subpoena him and have him under oath now. And I have got several questions.

Ms. ESHOO. Yes. So I have no doubt that Roger Sherman is going to make extraordinary contributions at the FCC. We all look forward to working with you in the new role, Roger. And from a very deep respectful place, we salute you. You have devoted yourself. You could make so much money outside of this institution. But he has—he remains with it because he has such a great commitment to it. And I think that that is a very important story for the American people, because he is here to help to create wins for our country. And I don't think there could be any more beautiful commitment. And we need people like you to continue on in public service. You have certainly enhanced my and all of ours here. So we are going to miss you. We thank you enormously. We thank you enormously for everything that you have done. And I will never ever forget it. I am a better legislator because of you. But more importantly, you have made great contributions to the entire subcommittee and the full committee. So God bless you. Go forward and do great things at the FCC. And when things aren't working out, you are going to be our point man. We are not letting you go. So, Mr. Chairman—

Mr. WALDEN. And remember—

Ms. ESHOO. Thank you.

Mr. WALDEN [continuing]. Remember that the FCC is an offshoot of the Congress. And so never forget that either as you go downtown.

Ms. ESHOO. That is right. Yes. Yes. Thank you.

Mr. WALDEN. How about a round of applause for Roger Sherman?

Ms. ESHOO. Thank you, Mr. Sherman.

Mr. WALDEN. And on that happy and appropriate note, that concludes our hearing. We thank our witnesses again for sharing your

comments with us, your testimony, your counsel and guidance. And we stand adjourned.

[Whereupon, at 3:59 p.m., the subcommittee was adjourned.]

[Material submitted for inclusion in the record follows:]

#### PREPARED STATEMENT OF HON. LEONARD LANCE

Thank you Mr. Chairman,

I'm glad we are having this hearing to examine how the 5 GHz spectrum band can be used in the most effective way possible. It is my goal to ensure that we are using our entire spectrum in the most efficient way possible and to promote advancement of both incumbent services and the myriad unlicensed products and services that are becoming ubiquitous in our daily lives.

I think this Committee took the correct approach in directing the FCC and NTIA to examine the possibility of expanding the use of unlicensed devices in the 5 GHz bands as long as they do not cause harmful interference to the incumbent licensed operators already operating here. Much of this work has been done and I look forward to its work formally being finalized. There is a strong likelihood that we can make more efficient use of this spectrum and allow continued innovation of unlicensed devices using spectrum in this range without unduly hamstringing the commercial and public safety incumbents currently holding licenses.

In recent years the innovation in devices making use of unlicensed spectrum has been breathtaking. Wi-fi internet access is no longer something restricted to our residences. The wireless phone carriers are "offloading" data traffic to Wi-fi hot spots at ever growing rates due to their own spectrum crunch. There are fewer and fewer public places without publically available Wi-fi. It has even been used to protect public safety. In the aftermath of Hurricane Sandy Cable companies opened their Wi-fi networks to first responders aiding in communication during the recovery. Bluetooth technology continues to advance, connecting us to our devices and residences in more and more effective and innovative ways. Remote controlled toys, wireless microphones, garage door openers, cordless phones and other devices also use unlicensed spectrum to operate.

The band we are discussing today seems to be the logical place to increase these products and services but we also must take care not to foreclose completely the incumbent license holders already making use of this band. There is innovative and important research and development taking place by auto companies and important services being provided by satellite providers and radar operations already licensed here. It is important that we find the right balance to ensure that these services continue to operate as well.

Qualcomm Research—located in my district in Bridgewater, New Jersey—has a long history of innovation in wireless systems, silicon design and infrastructure products. The Bridgewater facility focuses on the development and design of small cell networks, mobile ad hoc and device-to-device communications, telematics and related wireless technologies.

Engineers from Qualcomm Research in Bridgewater and other Qualcomm facilities are working with NHTSA and the automobile manufacturers at the renowned University of Michigan Transportation Research Institute to ensure the rapid roll-out and proliferation of innovative and potentially life-saving Dedicated Short Range Communications (DSRC) services in the 5.9 GHz band, specifically the 75 MHz from 5.850 to 5.925 GHz allocated to DSRC.

As we are progressing on DSRC, demand for Wi-fi continues to grow exponentially. We all recognize that as a nation we must be efficient in the way we allocate and utilize spectrum and what made sense ten or twenty years ago no longer works. At today's hearing we will hear from both Cisco and Comcast about the need for additional spectrum to support Wi-fi. Cisco points out that global mobile data increased 70 percent in just one year from 2011 to 2012. I appreciate all that Cisco, Comcast, Qualcomm and others are doing every day to advance Wi-fi services for American consumers.

The challenge we face as policymakers is to find a way to advance both DSRC and Wi-fi. The FCC allocated the 75 MHz between 5.850 and 5.925 GHz in 1999—long before Wi-fi was on the horizon and when DSRC was in its infancy. Given rapid technological advances since 1999, it is logical to ask whether Wi-fi can share with DSRC on a secondary basis in a way that accommodates both activities.

In a May 28 filing with the FCC, Qualcomm stated that sharing would place DSRC safety services at risk of harmful interference. Qualcomm suggested a middle-ground alternative under which the upper portion of the 75 MHz—20–30 MHz—would be exclusively dedicated to DSRC so as to avoid any interference problem, while al-

lowing Wi-fi to share with DSRC in the remaining spectrum on a secondary basis, but only if this sharing works on a non-interfering basis.

The Qualcomm proposal may not be the final answer to how to reconcile DSRC and Wi-fi. However, the proposal does provide a framework for discussion among all interested parties so that their talented and dedicated engineers can develop a solution. After all, virtually every American has a compelling interest in better wireless communications.

Thank you again for holding this important hearing.

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FRED UPTON, MICHIGAN  
CHAIRMAN

HENRY A. WAXMAN, CALIFORNIA  
RANKING MEMBER

ONE HUNDRED THIRTEENTH CONGRESS  
**Congress of the United States**  
**House of Representatives**  
COMMITTEE ON ENERGY AND COMMERCE  
2125 RAYBURN HOUSE OFFICE BUILDING  
WASHINGTON, DC 20515-6115  
Majority (202) 225-2927  
Minority (202) 225-3641

December 20, 2013

Mr. Julius Knapp  
Chief  
Office of Engineering and Technology  
Federal Communications Commission  
445 12th Street, S.W.  
Washington, D.C. 20554

Dear Mr. Knapp:

Thank you for appearing before the Subcommittee on Communications and Technology on November 13, 2013, to testify at the hearing entitled "Challenges and Opportunities in the 5 GHz Spectrum Band."

Pursuant to the Rules of the Committee on Energy and Commerce, the hearing record remains open for ten business days to permit Members to submit additional questions for the record, which are attached. The format of your responses to these questions should be as follows: (1) the name of the Member whose question you are addressing, (2) the complete text of the question you are addressing in bold, and (3) your answer to that question in plain text.

To facilitate the printing of the hearing record, please respond to these questions by the close of business on January 14, 2014. Your responses should be e-mailed to the Legislative Clerk in Word format at [Charlotte.Savercool@mail.house.gov](mailto:Charlotte.Savercool@mail.house.gov) and mailed to Charlotte Savercool, Legislative Clerk, Committee on Energy and Commerce, 2125 Rayburn House Office Building, Washington, D.C. 20515.

Thank you again for your time and effort preparing and delivering testimony before the Subcommittee.

Sincerely,



Greg Walden  
Chairman  
Subcommittee on Communications and Technology

cc: Anna Eshoo, Ranking Member, Subcommittee on Communications and Technology

Attachment



**Julius P. Knapp**  
**Chief, Office of Engineering and Technology**  
**Federal Communications Commission**

**Before**  
**The U.S. House of Representatives Committee on Energy and Commerce Subcommittee on**  
**Communications and Technology**

**“Challenges and Opportunities in the 5 GHz Spectrum Band”**

**November 13, 2013**

**Additional Questions for the Record**

**The Honorable Steve Scalise**

1. You state in your testimony that “permitting additional shared use requires significant collaboration with stakeholders to enable non-interfering shared use of the spectrum.” Can you elaborate what type of collaboration will definitely ensure that a plan will not interfere with incumbents?

**Answer:** The Commission has not proposed to take away any incumbent user’s right to operate as a licensed service in the 5 GHz band. As with all unlicensed services, U-NII devices may not cause harmful interference to licensed services, and must accept any harmful interference that they receive. It is our hope that all parties will work together in good faith to overcome the technical and policy challenges to find a way to effectively share spectrum in the 5 GHz band.

Sharing often works best when there is direct dialogue between the incumbent services and the parties hoping to introduce new products and services. I am pleased that parties both within the private sector and various government agencies are directly communicating and considering potential sharing solutions. The Commission welcomes these efforts, and will continue to engage with all interested parties and carefully review potential technical solutions.

2. From a spectrum propagation perspective, can you talk about potential interference by expanding unlicensed use from indoor use to outdoor use as well?

FRED UPTON, MICHIGAN  
CHAIRMAN

HENRY A. WAXMAN, CALIFORNIA  
RANKING MEMBER

ONE HUNDRED THIRTEENTH CONGRESS  
**Congress of the United States**  
**House of Representatives**  
COMMITTEE ON ENERGY AND COMMERCE  
2125 RAYBURN HOUSE OFFICE BUILDING  
WASHINGTON, DC 20515-6115  
Majority (202) 225-2927  
Minority (202) 225-3641

December 20, 2013

Mr. John Kenney  
Senior Research Manager  
Toyota InfoTechnology Center  
465 Bernardo Avenue  
Mountain View, CA 94043

Dear Mr. Kenney:

Thank you for appearing before the Subcommittee on Communications and Technology on November 13, 2013, to testify at the hearing entitled "Challenges and Opportunities in the 5 GHz Spectrum Band."

Pursuant to the Rules of the Committee on Energy and Commerce, the hearing record remains open for ten business days to permit Members to submit additional questions for the record, which are attached. The format of your responses to these questions should be as follows: (1) the name of the Member whose question you are addressing, (2) the complete text of the question you are addressing in bold, and (3) your answer to that question in plain text.

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Thank you again for your time and effort preparing and delivering testimony before the Subcommittee.

Sincerely,



Greg Walden  
Chairman

Subcommittee on Communications and Technology

cc: Anna Eshoo, Ranking Member, Subcommittee on Communications and Technology

Attachment

John Kenney  
Principal Researcher  
Toyota InfoTechnology Center, U.S.A., Inc.  
“Challenges and Opportunities in the 5 GHz Spectrum Band”  
Additional Questions for the Record

**The Honorable Henry Waxman**

**1. Do you believe the technical and engineering discussions between the Wi-Fi and the Intelligent Transportation Systems (ITS) communities are going well? What can the Administration do to support these discussions?**

In August of 2013, the Regulatory Standing Committee of IEEE 802.11 created a “tiger team” comprised of interested participants from the Wi-Fi and the Intelligent Transportation Systems (ITS) communities to exchange technical information and explore possible solutions to sharing in the 5.9 GHz band. These discussions are currently ongoing and have garnered participation by a significant number of people from within both communities. Although a couple preliminary sharing solutions have been proposed, participants from the Wi-Fi community have yet to reach consensus on a proposal. Once consensus has been achieved and prototypes are developed, field testing of the sharing technique can commence. We expect that the ITS community will be heavily involved in this field testing, which will likely occur outside of the “tiger team” process.

We welcome the continued interest and engagement of the Administration in this issue. The federal Department of Transportation (DOT) is monitoring the “tiger team” efforts. We encourage the continued involvement of DOT and welcome other federal agencies interested in the outcome of these discussions. We also appreciate that the Federal Communications Commission (FCC) has delayed further action on the Notice of Proposed Rulemaking pending the outcome of these discussions, and encourage it to continue to do so. Finally, we appreciate that the FCC has reaffirmed that the prohibition of harmful interference under Part 15.5 of the Commission’s rules applies to any potential use of the 5.9 GHz band by unlicensed devices, and believe that this important point should continue to be reiterated publicly.

FRED UPTON, MICHIGAN  
CHAIRMAN

HENRY A. WAXMAN, CALIFORNIA  
RANKING MEMBER

ONE HUNDRED THIRTEENTH CONGRESS  
**Congress of the United States**  
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COMMITTEE ON ENERGY AND COMMERCE  
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WASHINGTON, DC 20515-6115  
Majority (202) 225-2927  
Minority (202) 225-3541

December 20, 2013

Mr. Tom Nagel  
Senior Vice President, Business Development  
Comcast  
1701 John F Kennedy Blvd.  
Philadelphia, PA 19103

Dear Mr. Nagel:


Thank you for appearing before the Subcommittee on Communications and Technology on November 13, 2013, to testify at the hearing entitled "Challenges and Opportunities in the 5 GHz Spectrum Band."

Pursuant to the Rules of the Committee on Energy and Commerce, the hearing record remains open for ten business days to permit Members to submit additional questions for the record, which are attached. The format of your responses to these questions should be as follows: (1) the name of the Member whose question you are addressing, (2) the complete text of the question you are addressing in bold, and (3) your answer to that question in plain text.

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Thank you again for your time and effort preparing and delivering testimony before the Subcommittee.

Sincerely,

  
Greg Walden  
Chairman

Subcommittee on Communications and Technology

cc: Anna Eshoo, Ranking Member, Subcommittee on Communications and Technology

Attachment

January 13, 2014

Responses for the record from Tom Nagel, Senior Vice President, Strategic Initiatives,  
Comcast Corporation

House Energy and Commerce Subcommittee on Communications and Technology  
Hearing - "Challenges and Opportunities in the 5 GHz Spectrum Band"  
November 13, 2013.

### **POST-HEARING QUESTIONS**

#### **The Honorable Steve Scalise**

1. Can you provide some details on outreach that Comcast and other providers have done with potentially impacted incumbent providers? Have you been able to begin a dialogue on possibly co-existing in the band while not interfering with each other's services?

#### ***Comcast Response***

Because Comcast sees UNII-4 as critical to addressing the Wi-Fi spectrum crunch, and to bringing 802.11ac "Gigabit" Wi-Fi to American consumers, we have worked hard on outreach to ITS interests. Working with and/or through the National Cable & Telecommunications Association (NCTA), we have met with a variety of ITS interests, ITS equipment vendors, and have joined an IEEE group that is discussing technical sharing approaches. Comcast and other cable companies have brought our engineers to Washington for several in-person meetings with ITS engineers, and have an ongoing presence on the IEEE discussion group. We are committed to continuing this outreach and these discussions.

But we cannot afford to allow discussions to become delay tactics. The only way that these discussions have a hope of achieving progress is if all sides are committed to flexibility. Ten years after the FCC made the spectrum available for DSRC, there is still not a single commercial DSRC product available for sale. This gives us a golden opportunity to find a sharing approach that is technically and economically feasible without having to account for devices that are already in the hands of consumers. But to do this we all have to be willing to compromise on our approach to using the band in the future so we can find ways to share. If one party refuses to consider technical changes to future products – or even to consider using different channels within the UNII-4 band than originally planned – then a consensus approach will be impossible. Comcast stands ready to be flexible. But if others are not we ask Congress to support an FCC process that acts to balance the equities even in the absence of consensus.

**The Honorable Henry Waxman**

1. Do you believe the technical and engineering discussions between the Wi-Fi and Intelligent Transportation Systems (ITS) communities are going well? What can the Administration do to support these discussions?

***Comcast Response***

Comcast believes that the UNII-4 band holds extraordinary promise to address the Wi-Fi spectrum exhaust problem, and to deliver 802.11ac "gigabit" Wi-Fi to American consumers. We also believe that the best path forward is one where Wi-Fi and ITS share the band in a way that Wi-Fi does not cause harmful interference to deployed ITS systems.

As a consequence, we have worked hard to reach out to the ITS/DSRC community. The ITS industry first asked the FCC for access to this spectrum in 1997, and the FCC opened up the band for DSRC a decade ago. Today, however, there are still no commercial DSRC products. This gives us a golden opportunity to set rational rules without the need to account for devices that are already in the field. But while discussions are underway, they have not made forward progress.

The only way that a consensus approach is possible is if all parties are willing to be flexible – most importantly by agreeing to adjust their approaches, including things as simple as the channels within the UNII-4 band that they wish to use for future services. Comcast is ready to make a compromise work and we hope that the ITS/DSRC interests will take the same approach. The best way that the Administration could support constructive discussions therefore would be to make it clear that all parties must be willing to adjust their technical approaches to make sharing work, and to indicate that if one set of interests refuses to do so the FCC will adopt rules that properly balance the equities even in the absence of consensus.

**Waxman 2:**

What is your perspective on the proposals that have been put forth by Qualcomm and Cisco to resolve the interference challenge of sharing Wi-Fi devices with DSRC devices in the same band?

***Comcast Response***

Qualcomm and Cisco are equipment vendors that serve both ITS and Wi-Fi companies. So the fact that they have offered proposals for effective sharing is very meaningful – each company understands the relevant technologies and has an incentive to find a balanced solution. Comcast is actively in talks with both Qualcomm and Cisco to explore whether either approach would be technically and

economically viable for our Wi-Fi network. We intend to pursue both paths, and, as we understand the implications of each, determine whether one or both could offer the best way forward. But it is critical that all parties – Wi-Fi and ITS interests alike – keep their minds open as we work together. Some ITS interests have refused to even consider the Qualcomm approach. This is counterproductive. Consequently, we encourage Congress to strongly advise all parties to roll up their sleeves, make compromises, be willing to adjust their technical approaches, and find the best way to maximize the overall value of the band to American consumers.

FRED UPTON, MICHIGAN  
CHAIRMAN

HENRY A. WAXMAN, CALIFORNIA  
RANKING MEMBER

ONE HUNDRED THIRTEENTH CONGRESS  
**Congress of the United States**  
**House of Representatives**  
COMMITTEE ON ENERGY AND COMMERCE  
2125 RAYBURN HOUSE OFFICE BUILDING  
WASHINGTON, DC 20515-6115  
Majority (2021 225-2927)  
Minority (2021 225-3641)

December 20, 2013

Mr. Bob Friday  
Vice President and Chief Technology Officer  
Cisco  
601 Pennsylvania Avenue, N.W., North Building, Suite 900  
Washington, D.C. 20004

Dear Mr. Friday:

Thank you for appearing before the Subcommittee on Communications and Technology on November 13, 2013, to testify at the hearing entitled "Challenges and Opportunities in the 5 GHz Spectrum Band."

Pursuant to the Rules of the Committee on Energy and Commerce, the hearing record remains open for ten business days to permit Members to submit additional questions for the record, which are attached. The format of your responses to these questions should be as follows: (1) the name of the Member whose question you are addressing, (2) the complete text of the question you are addressing in bold, and (3) your answer to that question in plain text.

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Thank you again for your time and effort preparing and delivering testimony before the Subcommittee.

Sincerely,



Greg Walden  
Chairman  
Subcommittee on Communications and Technology

cc: Anna Eshoo, Ranking Member, Subcommittee on Communications and Technology

Attachment





May 6, 2014

Charlotte Savercool  
Legislative Clerk  
Committee on Energy and Commerce  
2125 Rayburn House Office Building  
Washington D.C. 20515

Re: Subcommittee on Communications and Technology, Hearing on "Challenges and Opportunities in the 5 GHz Spectrum Band"

Dear Mr. Savercool:

This letter responds to the request for additional information from Cisco's Bob Friday, Vice President and Chief Technology Officer, who appeared before the Committee on November 13, 2013.

The question for the record, posed by Mr. Waxman, is:

1. Do you believe the technical and engineering discussions between the Wi-Fi and Intelligent Transportation (ITS) communities are going well? What can the Administration do to support these efforts?

Answer: The Wi-Fi and ITS communities have agreed to utilize an informal IEEE process to meet and exchange technical and engineering views on the ability of IEEE 802.11ac (Wi-Fi) radios to use spectrum designated for IEEE 802.11p (Dedicated Short Range Communications) radios in a way that would ensure the safety of life mission of the 802.11p systems is not compromised. Two distinct ideas have been floated which could be tested individually and/or in combination. Conversations and information exchange has taken place both in the context of the IEEE teleconferences, which generally have attracted between 30-40 engineers, as well as outside of the calls. In Cisco's view, this is a normal industry approach to determining if other ideas might exist, or to refine the ideas that have been brought forward. At a point in time when the Federal Communications Commission (FCC) is satisfied that these talks have reasonably identified ideas that are worthy of further study, the FCC will need to call for data and evidence demonstrating the efficacy of the approaches identified, and lead a technical discussion among stakeholders focused on whether the approaches should be tested, or further evolved prior to

testing. At the point at which a decision is made to test, there are a range of decisions that will also need to be made on how to begin to test sharing technology – decisions that will necessarily involve the Departments of Commerce (NTIA) and Transportation, the National Highway Transportation Safety Administration, and other stakeholders. As the entity with the greatest experience testing sharing technologies, the FCC should lead the discussion of a test plan in consultation with the relevant federal agencies. We appreciate the Committee's continued oversight of the process and will keep you apprised of our progress.

Respectfully submitted,

*/s/Mary L. Brown*

Mary L. Brown  
Director, Government Affairs  
Cisco Systems, Inc.  
601 Pennsylvania Ave. NW  
9<sup>th</sup> floor North  
Washington DC 20004  
(202) 354 2923